C. L. Babcock

Vol. 51 No. 3 January 1958

Quarterly

of the

National Fire Protection Association

INTERNATIONAL

Promoting the Science and Improving the Methods of Fire Prevention and Protection Since 1896

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Vol. 51 No. 3 January 1958

Quarterly

The Standard Technical Journal of Fire Protection for More Than Forty Years

The NFPA is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 17,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include *Fire News*, *Advance Reports* to the Annual Meeting, a *Year Book*, and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control. Six volumes of the National Fire Codes are available on an annual subscription basis, one volume free and others at reduced membership rates. For full details on available material ask for the free "List of NFPA Publications."

NFPA annual dues are $15.00 for Associate Membership of which $6.00 is for subscription to this Journal. National and regional societies or associations may apply for an organization membership for which annual dues are $100; such a membership entitles four individuals to receive the periodical membership publications.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

National Fire Protection Association

International

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Quarterly

of the

NATIONAL FIRE PROTECTION ASSOCIATION

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Table of Contents

Gas Explosion at Villa Rica, Georgia ..... Frontispiece
Editorials
Charles L. Smith 155
The Future Is a Challenge 155
Civil Defense 156
Fire Protection Developments in 1957
Percy Bughee, General Manager, NFPA 157
Study of Gas Explosions and Fires 160
Gas Explosions 161
Piping 161
Appliances 180
Compressor Stations 185
Utility Gas Plants 186
Unexplained Explosions 187
Gas Fires 189
Piping 189
Appliances 193
Utility Gas Plants 194
Prussian Fire Protection 300 Years Ago
Reinhold A. Dorwart, The University of Connecticut 195
Civil Recourse in Fire Losses
Michael H. Bagot 206
Index to Advertisers 212

Articles and accounts of fires appearing in the Quarterly are based on material forwarded to the Association. The Association, as a body, does not assume responsibility for the accuracy of the material printed herein.

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A natural gas explosion at Villa Rica, Georgia on Dec. 5, 1957 killed 12 persons and injured more than 20. For several days gas odor was reported by occupants of the 2-story building. Subsequent tests by the fire chief and an employee of the Villa Rica Gas Department using open flames did not locate the source. At the time of the explosion, two plumbers were in the rear of the first floor drug store working at a gas-fired storage water heater. Survivors' reports suggest the possibility of the escape of a large volume of gas at the water heater just prior to the explosion. A detailed report appears in the January 1958 NFPA Fire News. For a study of other gas explosions and fires see page 160.

Editorials

Charles L. Smith 1908-1957

THE sudden passing on November 12, 1957 of our Electrical Field Engineer, Charles L. Smith, of Chicago, was a blow to the NFPA staff and to many of our members. Mr. Smith became our Electrical Field Engineer on April 1 of 1948 from the position as Chief Electrical Inspector of the City of Detroit. During the years of his service with us, he functioned admirably and effectively not only as Electrical Field Engineer of NFPA in the promotion throughout the country of the National Electrical Code, but also as Secretary of our Electrical Section which produces the National Electrical Code and as Secretary-Treasurer of the International Association of Electrical Inspectors. In these various capacities, Mr. Smith made many contributions to the strength and prestige of the National Electrical Code and to the increasing prestige and effectiveness of the International Association of Electrical Inspectors. His genial personality and capacity for friendships endeared him to the NFPA staff, to the electrical industry, and particularly to the many electrical inspectors who looked upon him as an ever-present friend and reliable source of help. We know that every NFPA member joins with us in a sincere sense of loss.

The Future Is a Challenge

FIRE protection engineering will become more important to humanity in the future according to Mr. W. G. Schultz, President of the Society of Fire Protection Engineers, who spoke at the opening session of the NFPA's Fall Conference in Richmond, November 18–20, 1957.

Scientific and economic developments are progressing so fast it is almost impossible to keep up with the changes. The search for more and more energy per pound of fuel in the development of such things as interplanetary missiles, the need for better insulation and cooling systems, the importance of more complete research on combustion and rates of flame propagation — all these and many more indicate some of the reasons why fire protection engineers will become increasingly vital in our tomorrows.

Economists inform us that in the next decade a twenty-five per cent expansion

of our industrial productivity will be needed to make products unheard of today. Scientists are producing with atomic bombardment and high temperature treatments elemental materials never before in existence. Sociologists tell us that we are in a population explosion. The curve of world population is going straight up. The present population is equal to about eight per cent of the number of people who have ever inhabited this globe.

Radioactive isotopes will show us mysteries of life hitherto unknown. Plants will grow from four to ten times the size of the largest species existing today. Illumination by stored sunlight may replace electric lighting systems. Foods preserved by atomic radiation are a reality that may revolutionize food packing and the frozen food industry. Transportation by automobile is already a serious problem. The two-car garage may be as obsolete as the stable and carriage house and a folding, portable, individual jet pack may make all roads obsolete. Huge warehouses of plastic fabric air structure are a reality and plastic building products may make carpentry and masonry things of the past.

We are living in an age which demands that each of us keep abreast of the problems in his own field. These changes are apt to be so far reaching that each professional group will have its hands full trying to keep up with the impact of scientific advancements on its own specialties. The days when civil, mechanical, electrical and chemical engineering were the only engineering professions are as out of date as the horse and buggy. The future demands more specialization in industry, not less. Fire protection engineers must be prepared to meet the challenges of the future.

Civil Defense

THE General Manager and Chief Engineer of the National Fire Protection Association have been working actively with the federal government on matters pertaining to civil defense both during and following World War II. In carrying out their responsibilities they have been forced to be critical of the Federal Civil Defense Agency in opposing the programs which that agency has advanced — first, advocating evacuation of population centers and second, proposals for underground shelters for urban populations.

The position taken by Messrs. Bugbee and Bond has been interestingly supported by Robert Moses in "Harper's Magazine" for November 1957. The NFPA has advocated that the existing emergency services in our cities, such as the fire departments, should be the backbone of civil defense organization and Mr. Moses in his article states: "As to volunteer civil defense organizations, the only municipal agency I know of which can effectively serve to direct volunteers is the fire department. At relatively small expense, it could assume this responsibility . . . The regular fire force is always the chief instrument in catastrophes involving explosions, fire and similar disasters . . . Such talent need not be discouraged."

The only hope, as we see it, for civil defense is to recognize that our fire departments are the logical emergency service around which to build a sound program and we recommend Mr. Moses' article to those interested in furthering this objective.

Fire Protection Developments in 1957

By Percy Bugbee, General Manager,
National Fire Protection Association.

The over-all trends of fire losses during recent years appear to have continued during 1957. All of the evidence that we have been able to accumulate indicates that there is some over-all reduction in loss of life from fires and that there is quite likely an over-all reduction in the total number of fires. The trend of an increasing number of large loss fires continues and the total dollar loss continues to mount although we are not at all certain that the amount of physical property being destroyed by fire is actually greater because of the pronounced inflationary factor.

Each fall we attempt estimates of the volume of fires and our current estimates for the previous year of 1956 are that there were some 1,940,000 outbreaks of fire. Of these, 824,000 were in buildings and 523,000 in one- and two-family dwellings. The principal causes of building fires remain the same. Fires due to heating equipment of all kinds run to about 175,000, fires from smoking and matches 127,000, and fires from electrical causes 106,000.

Loss of Life Disasters

The early part of 1957 was marked by three major loss of life disasters in nursing homes; one in Council Bluffs, Iowa on February 13 causing 15 deaths; one in Warrenton, Mo. on February 17 causing 72 deaths; and one at Pointe-aux-Trembles, Quebec, on April 13 causing 17 deaths. As might be expected, these fires caused a substantial amount of concern and activity in more adequate protection for nursing homes and homes for the aged and a number of states adopted comprehensive legislation in 1957 covering these occupancies. Connecticut, Iowa, Louisiana and Georgia are among the states that have devoted special attention to this problem.

There was also an epidemic of large church fires in the early months of 1957. A factory fire in New Haven, Conn. in January cost 15 lives, the main factor being an old-fashioned type of open fire escape passing unprotected window openings.

Fire Departments

During the past year, considerable attention has been focused on the problem facing many of our municipal fire departments, particularly in the field of manpower. Manpower troubles in our present-day fire departments stem from the quite natural demand of firemen for hours of work and pay comparable to other services. In many cases city officials and taxpayers have been quite willing to recognize the claims of the firemen and have granted shorter working hours, but in these days of constantly rising municipal costs the taxpayers have not been so ready to make up for the shorter hours by adding the necessary complement of additional men.

The practice of many of our departments in permitting the firemen to take outside employment appears to many to have served to increase the problems of the departments. This practice has certainly made it more difficult for the firemen to demand and secure wage increases. Permitting the firemen to take outside employment has not been the panacea that many municipal authorities have thought it might be.

In spite of a large amount of promotion on the part of certain advocates in the field of municipal administration that a solution to some of these problems lies in integration of fire and police departments, particularly in smaller communities, this proposal does not

appear to have made very substantial headway. We have not seen any convincing evidence in the few cities that are trying out integrated fire and police departments that a satisfactory fire department has been secured through this method.

It is most encouraging to be able to say that the trend towards more adequate and comprehensive inspection of all types of properties by municipal fire departments continues undiminished. The campaign for regular inspection of all dwellings by fire departments fostered by the International Association of Fire Chiefs, and strongly supported by NFPA and other fire protection organizations, has made substantial progress. There is ample evidence now to show that this contribution by a local fire department materially reduces loss of life and fires in ordinary dwellings. This sort of work can be done at no extra expense to the taxpayer and with greatly improved public relations for the fire department so that all concerned benefit. We hope and believe that in time all of our more than 20,000 organized fire departments will carry on dwelling inspections as a matter of routine.

The Fire Research Committee of the National Academy of Sciences, initiated through a grant of funds from the Federal Civil Defense Administration to study large fires and their physical characteristics, has led to a potentially useful and interesting investigation now going on through this committee as to the possibilities of using the Operations Research Technique for a study of fire fighting and particularly of fighting large fires.

A development that we believe may be of very great importance in improving the efficiency of fire department administration and operation was the organization in 1957 of a new NFPA Committee on Fire Department Organization which will have the responsibility of studying and suggesting improvement in the organization and operation of the modern fire department. Creation of this committee has aroused keen interest on the part of fire chiefs, city managers, and others interested in fire department operations.

The trend of recent years of providing adequate training for all fire departments, large and small, was maintained in 1957. According to a survey made by NFPA, some 125,000 firemen received training in state-wide and provincial programs, this in addition to the many training programs operated by individual fire departments.

Standards

In the technical field much substantial progress can be reported for 1957. A number of new and very important additions to fire safety standards were adopted by NFPA at its annual meeting in Los Angeles in May. These include the new (14th edition) of the BUILDING EXITS CODE, new standards for AIRCRAFT RESCUE AND FIRE FIGHTING SERVICES FOR AIRPORTS, a new standard on MOTOR FIRE APPARATUS, a new FLAMMABLE LIQUIDS CODE, and new standards on GARAGES and on CHIMNEYS AND FLUES. All of these represent major contributions to fire safety.

The 1957 edition of the NATIONAL FIRE CODES published by NFPA ran to six large volumes of more than 4400 pages. Other major contributions to fire protection literature of the year include the book on RESEARCH ON FIRE which is a survey of all of the fire research activity presently being carried on throughout the world, a REPORT OF IMPORTANT DUST EXPLOSIONS classified by occupancy, and a comprehensive FLAMMABLE LIQUIDS TRADE NAME INDEX.

Public Education

In the field of general education of the public in fire prevention, it is satisfying to be able to report that the SPARKY campaign, which is an NFPA, year-round educational effort directed at the general public, continues to expand. SPARKY FIRE DEPARTMENTS for children

have sprung up in hundreds of communities all over the United States and Canada and thousands upon thousands of children are learning the principles of fire safety through this program. The junior fire marshal program, sponsored by the Hartford Fire Insurance Company, has enlisted many additional thousands of youngsters in the cause of fire safety.

Walt Disney made notable contributions to fire safety in providing two very appealing and attractive color cartoon films on fire safety, one called "I'm No Fool with Fire," and the other "How To Have an Accident in the Home." We also note with much satisfaction that the great Boy Scout movement is sponsoring a nation-wide safety program in 1958 and that fire protection will play a major part in this program.

Rackets

There is an undesirable development mentioned briefly in previous annual surveys that has made substantial headway during the past year. I refer to the large number of new firms springing up to market various types of unapproved and in many cases ineffective devices in the fields of fire extinguishment and fire detection. The more the general public is made aware of the need for fire safety because of the great educational campaigns that have been referred to, the more shady operators out to defraud the public seem to prosper. We are enlisting the support of the Better Business Bureaus throughout the country to stamp out these racketeers. Fire chiefs and others in positions of authority should be aware of their responsibilities to see that ineffective and undependable devices are not foisted on the public.

NFPA Activity

The National Fire Protection Association has again enjoyed a year of increased growth and activity in all phases of its work. The fact that during the past year well over ten million pieces of literature were distributed by NFPA is evidence of the increasing interest in and support of better fire protection and fire prevention.

Study of Gas Explosions and Fires

By the NFPA Fire Record Department

Explosions involving fuel gas in central piping distribution systems and in consumer properties and gas works served by or supplying such systems are briefly reviewed in this article. This study of 140 incidents in the files of the NFPA Fire Record Department, occurring during the 8-year period 1950–1957, supplements a previous study of 67 explosions during the 20-year period 1931–1950 which was published in the April 1950 NFPA QUARTERLY.

In addition to the 140 explosions reported, 23 cases are included in which ignition of escaping gas was the cause of a fire or contributed to the spread of a fire. In selecting the fires and explosions reviewed in this record, an effort was made to include a variety of occupancy types which would reflect the wide scope of the problems involved.

Purpose of the Study

This study of gas explosions and fires has been prepared to aid those interested in reducing the number of such accidents. It has been prepared with the cooperation of the gas industry which recognizes its responsibility to provide the public with a safe fuel.

Study Not a Measure of Safety of Gas

The principal conclusion that should be drawn from these case histories is the ever present need for vigilance in the proper installation, maintenance, repair and operation of gas piping and equipment.

Limited as it is to incidents involving gas piping and equipment, the study is in no sense a means of evaluating the safety of gas as a fuel and should not be used for that purpose. To anyone who might be mislead into doing so let it be said that the NFPA fire record files contain experience to permit similar studies of most other fuels. Gas, or any fuel, can be used safely when proper installation and maintenance procedures are followed.

Increase in Natural Gas Use

The number of utility gas service installations in the United States was 22,267,000 in 1950. By December 1957 this number had increased about 39 per cent. In 1950 there were 349,600 miles of transmission and utility distribution piping throughout the United States, — 545,700 miles in 1957. Another significant change that took place during the period covered by this record was the substantial increase in the use of natural gas. In 1956 the miles of natural gas and manufactured gas piping were 489,290 and 6,760 respectively, whereas in 1950 the corresponding mileages were 264,950 and 65,170.

Transmission and Distribution Piping

This rapid expansion of the use of natural gas emphasized the need for standards for the installation and maintenance of gas transmission and distribution piping systems. Under the sponsorship of the American Society of Mechanical Engineers, Section 8 of the American Standard for Pressure Piping (ASA B31.1) was reviewed and expanded to cover the design, installation and maintenance of gas transmission and distribution systems. Section 8 of ASA B31.1 — 1955 can be obtained from the American Society of Mechanical Engineers and from the American Gas Association.

Building Piping and Appliances

The NFPA has had for many years a Standard for the Installation of Gas Piping and Gas Appliances in Buildings (NFPA No. 54). This Standard is available from the NFPA in National Fire Codes Volume I, and as a separate pamphlet. It is also available from the American Gas Association (ASA Z21.30) and from the National Board of Fire Underwriters (No. 54).

Need for Cooperation

Many explosions in this record involved gas that had escaped from pipes broken by contractors' crews during excavation work. There were also several incidents where fire control was delayed because gas shutoff valves were inaccessible. Thus, another important conclusion from this study is the necessity of closer coordination of the activities of gas companies, contractors and fire departments. NFPA pamphlet No. 328M, Control of Flammable Liquids and Gases in Manholes, Sewers and Similar Underground Structures, suggests appropriate steps to be taken to assure the necessary coordination among these groups.

Gas Explosions Reported in this Record

	No. of Explosions		No. of Fatalities	
PIPING				
Distribution piping	43		39	
Service piping to buildings	21		35	
Transmission piping	17		9	
Building piping	14		19	
		95		102
APPLIANCES				
Industrial	15		1	
Domestic and commercial	11		7	
		26		8
COMPRESSOR STATIONS		5		3
UTILITY GAS PLANTS		4		0
UNEXPLAINED EXPLOSIONS		10		5
		140		118

GAS EXPLOSIONS

Piping

Distribution Piping

Dwelling, Detroit, Mich., May 29, 1950; 2 killed

An explosion that blew out the walls of this 1-story dwelling killed two children. The explosion occurred when their mother went to the basement and lit a match to heat a pot of coffee on a gas stove. The explosion involved gas that had entered the building from a break in a gas distribution pipe about 40 feet from the building. The break occurred during street construction work and was apparently caused when a 60-ton drag line scoop passed over the pipe.

Radio Warehouse, Sandusky, Ohio, Nov. 14, 1950. $172,000

The 2-story wood-framed, metalclad building was practically destroyed by fire that followed a gas explosion in the first story. The explosion originated in a first story office after the warehouse had closed for the night and involved gas that had leaked from a street main and followed water and gas pipes into the building. A gas-fired hot water radiator in the office was the ignition source.

Grocery Store, Pontiac, Mich., Dec. 31, 1950. $65,000

Gas escaping from a break in a 12-inch street main seeped into the basement of the 1-story brick, wood-joisted building. A gas explosion in the basement demolished the building.

Dwelling, St. Louis, Mo., Feb. 6, 1951

The 2-story brick, wood-joisted 2-family dwelling was extensively damaged by a gas explosion that occurred when one of the tenants went to the basement and opened the door on the stoker-fired warm air furnace.

While fire officials and gas company employees were investigating, the occupant of

an adjoining house told them she could smell gas in the basement. They checked unsuccessfully for its source and had been gone from the building about 10 minutes when an explosion occurred in the basement. At the time, an occupant was in the basement but he stated that he did not light a match or turn on the light.

On probing at the curb line in front of the building where the first explosion occurred, gas company employees found a broken gas distribution pipe.

Dwellings, Jefferson, Pa., Feb. 9, 1951. $100,000; 2 killed

Observer Publishing Co.

Two people were killed and six were injured in a series of gas explosions that wrecked six homes. The explosions involved natural gas that had entered the various buildings through storm sewer connections. The source of the gas was a break in a wrinkle bend on a 16-inch gas distribution pipe where it passed under a 24-in. terra-cotta storm sewer. At this location a 10-in. steel lateral sewer pipe had been cut into the terra-cotta storm sewer, providing an easy opening for the gas to enter the storm sewer system. The fact that the earth was frozen several inches deep prevented gas from escaping readily through the ground.

Metal Fabricating Plants and Dwelling, Pittsburgh, Pa., March 1, 1951. $285,000

A natural gas explosion at 8:00 P.M. demolished a 4,500 sq. ft. 1-story brick, wood-joisted building and damaged and set fire to a 1-story brick metalworking plant on one side and a 2-story brick dwelling on the other. Two persons in a passing automobile and two in the dwelling were injured. The gas is believed to have entered the building from a broken main, ruptured by one of several earth movements in the hilly area during the spring thaw.

Church, Appleton, Wis., March 11, 1951. $60,000

Opening the wrong valve permitted high pressure gas to flow into the low pressure mains supplying the section of the city where this church was located. Fortunately this mistake occurred when most buildings were occupied, since, on hearing the roar of their gas burning equipment, the occupants shut off the gas.

The unoccupied church, where a gas explosion occurred, was not so fortunate. It is theorized that gas leaked from the meter and ignited explosively at a pilot light. Two more explosions occurred after the fire department arrived and it was not until the curb valve was closed that the fire could be controlled. There was a 30-minute delay in closing the valve since all gas company employees were busy closing valves at other properties and could not be reached.

Bank, Portland, Ore., March 21, 1951. $65,000

Seven employees were injured by a gas explosion that originated in the basement of the bank. Gas from a leaking street main apparently had worked its way beneath the pavement and into the bank vault beneath the sidewalk where it ignited when an employee turned off the electric light in the vault.

Furniture Store, Stevens Point, Wis., June 11, 1951. $208,500; 1 killed

Propane gas leaking from a ruptured 3-in. cast iron main in the street is believed to have entered the basement of a 1-story concrete block, wood-joisted furniture store through holes and cracks in the basement wall. The building was located about 15

Acme

The wrong valve was opened at Appleton, Wis., on March 11, 1951, permitting high pressure gas to flow into the low pressure distribution system. Fire in this church was preceded by an explosion which is believed to have involved gas that escaped from the meter.

Rochester Democrat and Chronicle

Gas explosions occurred in 11 dwellings, fires broke out in 20 others and three persons lost their lives following release of high pressure gas into the low pressure distribution system at Brighton, N. Y., Sept. 21, 1951. The release of high pressure gas had followed an explosion in a pressure regulator vault which damaged regulators.

feet from the main which had ruptured. When a light switch was operated an explosion occurred that killed one occupant and injured two.

The roof was raised and the walls fell out allowing the roof to fall back into the building. Debris was thrown several hundred yards and within one or two minutes the wreckage was in flames. Extending roof eaves and unprotected windows afforded ready means for flames to reach an adjacent 1-story masonry, wood-joisted club building. This building and three 2-story wooden buildings across a 50-ft. street, ignited by radiated heat, were destroyed.

Dwellings, Brighton, N. Y., Sept. 21, 1951; 3 killed

A terrific explosion occurred in an underground gas pressure regulator vault. Regulators in series in the vault reduced natural gas pressure from 30 pounds psig to 6 inches of water pressure before the gas entered the low pressure distribution system. The explosion occurred as workmen who had been doing sidewalk work above the vault completed their day's work. Because of the extent of damage to the vault the source of the gas that had accumulated in the vault could not be determined. A lighted lantern at the sidewalk construction site may have been the ignition source.

Falling pieces of the vault's concrete roof damaged the pressure regulators. Lack of protective devices to prevent high pressure gas from entering the low pressure distribution system allowed high pressure gas to flow into individual houses where burners flared up. In some instances gas meters ruptured allowing free escape of gas into the basement. Explosions occurred in 11 dwellings and fire broke out in 20 others. Two children were killed when their home exploded, and a 70-year-old woman died of a heart attack. (For full details, see October 1951 QUARTERLY.)

Store and Dwelling, Pittsburgh, Pa., Oct. 31, 1951. $20,000; 1 killed

One woman was killed and 16 persons were injured when a violent gas explosion in the basement wrecked a 2-story wooden building and damaged four other nearby buildings. The gas entered the basement from a break in a 2-in. distribution pipe in the street.

Self-Service Food Store, Youngstown, Ohio, Dec. 17, 1951. $56,000

A customer was severely burned by a gas explosion that preceded fire in this 2,600 sq. ft. 1-story brick, plank and timber building. Following the explosion at 12:06 P.M. fire quickly engulfed the front part of the sales area cutting off the only front exit. Customers and employees escaped through a single rear door. Gas leaking from a street main is believed to have seeped into the basement of the store and then into the sales area where it was ignited when a customer lighted a cigarette.

Gas Distribution Piping, Milwaukee, Wis., July 24, 1952

Two gas company employees were painfully burned while preparing to "bleed" air from a recently installed 6-inch street main. As the cap on the main was being removed it was blown against a rock causing a spark that ignited escaping gas. Newspapers report that after the gas fire was extinguished by fire fighters using carbon dioxide it was reignited by a piece of smoldering wood and exploded with such force that a fireman was blown five feet and burned.

Storm Sewer, Houston, Texas, Oct. 13, 1952

Thirteen explosions in a storm sewer involved natural gas that entered the service from a break in a 2-in. street main carrying gas at 21 psi. The break was two blocks upgrade from the location of the first explosion and was attributed to extremely dry conditions that had caused deep cracks to occur in the ground in certain areas. There had been several gas pipe breaks, usually at elbows, in the vicinity of these ground cracks.

Oil Well Parts Mfg., Los Angeles, Calif., Nov. 6, 1953. $200,000

During Nov. 5 office employees thought they smelled gas but thinking it was probably the odor of fresh paint did nothing about it. At 5:00 P.M. when they put out the office lights a flash occurred at the light switch but after a brief check it was decided to wait until morning to call the gas company. In the morning the odor of gas was much stronger and when the light switch was operated an explosion occurred that injured three employees and extensively damaged the 2-story building.

Los Angeles Fire Department

This Los Angeles, Calif. factory was extensively damaged by a gas explosion on Nov. 6, 1953. A break was discovered in a gas distribution main in the street which was probably caused by earth settlement as an aftermath of storm sewer construction work.

During the ensuing fire firemen noticed gas bubbling up through water in the street. Later a break was discovered in a gas distribution pipe. The break was probably due to earth settlement which in turn may have been an aftermath of construction of a storm sewer about a year earlier.

Dwelling, Utica, N. Y., Dec. 22, 1953

On entering the 2-family house an occupant smelled gas, went to the basement to investigate and arrived in time to see "a ball of fire streak from the front to the rear of the basement." He and the other occupants escaped before an explosion blew holes in the roof and walls and blew out windows. Investigators determined that gas from a broken street main had spread beneath the ground and permeated the rear basement wall.

Housing Project under Construction, Cambridge, Mass., Dec. 27, 1953. $100,000

A 2-story, 4-apartment unit at the new housing project was badly damaged by a gas explosion that occurred during the holiday week end when no one was in the building. This and other buildings were ready for occupancy but tenants had not been allowed to move in because of complaints of gas leaks.

The housing project site was formerly a bog, necessitating the use of concrete piling for buildings. This support, however, was not provided for gas service piping and it is believed that the lack of support allowed piping to sink and develop leaks.

Department Store, Pottstown, Pa., Jan. 4, 1954. $137,900

An explosion in the basement of the 3-story brick, wood-joisted building blew out the front of the first story and started fire that spread through pipe openings to upper stories. Gas leaking from a broken 4-in. street main had seeped into the basement where it was ignited by a spark at a refrigeration system compressor motor.

City Hall, Hastings on Hudson, N. Y., Jan. 20, 1954. $20,000

Windows were broken and other structural damage was caused by a gas explosion in the fire alarm equipment room in the basement. The gas escaped from a break in a street main, entered a fire alarm circuit manhole and followed fire alarm conduit to the

fire alarm equipment room. The gas was ignited by sparks from relays in the alarm circuit when the town's fire alarm siren was given a test blast at 12:00 noon.

Dwelling, Stoneham, Mass., Jan. 21, 1954; 2 killed

Two occupants of the 1-story wooden dwelling suffered fatal burns when a natural gas explosion at 7:55 A.M. badly damaged the building and set fire to combustible contents. The gas had seeped into the house from a leaking 6-in. street main and ignited when one of the occupants struck a match to light a cigarette.

Dwelling, New Haven, Conn., Jan. 31, 1954. $39,000; 4 killed

Four persons were killed and three injured in a gas explosion at 5:49 A.M. that blew apart the 3-story wooden dwelling in which they were sleeping. The gas escaped from a break in a gas main 80 feet from the building and 52 inches beneath the ground. The gas spread beneath the frozen ground and into the cellar where it ignited.

Apartments and Stores, Philadelphia, Pa., Feb. 28, 1954; 5 killed

Five persons were trapped and killed and 35 were injured when two 3-story brick, wood-joisted buildings, each 675 sq. ft. in area, were demolished by explosions of leaking gas. The initial explosion occurred in the basement of one of the structures and may have been ignited by the flame of an oil burner or automatic gas water heater.

The gas is believed to have come from a break in a street main which occurred when water from a leaking water main washed earth from around the gas pipe.

Gas Distribution Pipe, Washington, D. C., March 17, 1954

While workmen were making a new connection to a 2-in. high pressure street main escaping gas was ignited explosively. Fire burned at the excavation for an hour until the valve in the street main could be closed.

Dwellings, Anderson, Ind., Oct. 9, 1954. $50,000

Two 1-story dwellings and three automobiles were practically destroyed by fire that followed a gas explosion in the street. The gas escaped from a newly installed insulated metal sleeve on a street main. The sleeve ruptured when workmen restored gas at 110 pounds pressure to the main. Ignition source was probably a kerosene lantern left by the excavation.

Anderson Fire Department

On Oct. 9, 1954 at Anderson, Ind., a gas explosion at a street excavation was followed by fire that destroyed two dwellings and three automobiles. The explosion involved gas that escaped from a newly installed insulated metal sleeve on a street main after gas pressure of 110 pounds had been restored to the main.

San Antonio Fire Department

Shortly before this school at San Antonio, Texas was to open on Feb. 8, 1956, it was demolished by a gas explosion. Investigators believe the gas came from a break in a street main.

Gasoline Service Station, Northlake, Ill., Dec. 2, 1954. $40,000

An explosion that blew out the front of the 1-story wooden service station was followed by fire that destroyed the building. Natural gas had entered the building from a street main that had been broken by a power shovel being operated by a sewer construction crew.

Dwelling, Colonie, N. Y., Feb. 6, 1955

The six members of the family occupying this 2-story wooden dwelling were seriously injured when a gas explosion demolished the house. It was determined that the gas entered the house from a broken circumferential weld in a 12-in. steel gas distribution pipe in front of the house.

The pipeline had been installed in 1925 before present-day methods of pipeline welding and testing had been developed. Other welds in the pipe were examined and found to be substandard (lack of penetration, slag inclusion and some cracks). A protracted cold spell during which frost penetrated to the depth of the main preceded the explosion. Earth movement due to the frost was probably responsible for the break at the substandard weld.

Dwelling, Paris, Ky., Feb. 6, 1955

When an occupant of the 2-story stone veneered, wooden dwelling opened the door of a basement room, gas that had accumulated in the room spread to the nearby gas-fired furnace and exploded. The occupant was critically injured by falling debris. Investigation revealed that the gas had escaped from a small pit hole in a 6-in. high pressure wrought steel main that had been laid in 1927 to carry gas from Paris to Cynthiana. Escaping gas traveled 20 feet beneath the frozen ground to the building and entered the basement through cracks in the foundation wall.

Dwelling, Westminster Twp., Ont., Feb. 22, 1955; 1 killed

When the 77-year-old occupant of this dwelling went into the bathroom and switched on the electric light a gas explosion occurred. He was so badly burned that he died five days later. The house was destroyed by the ensuing fire.

An untrapped tile drain extended from the basement floor to a tile drain in the street. A 2-in. natural gas distribution pipe ran parallel to the street tile drain and nine feet from it. Investigators found a broken 1½-in. nipple on the 2-in. pipe about 75 feet from the connection of the two tile drains. They concluded that the gas escaping from the broken nipple spread through the frozen ground, found its way into the tile drain and then flowed into the dwelling.

School, San Antonio, Texas, Feb. 8, 1956. $7,000

Shortly before school opened in the morning the janitor and a maid detected the odor of gas in the 1-story wooden building. On checking with a match, the janitor dis-

covered a small leak in piping to one of several gas-fired space heaters. He blew out the match, shut off the heater and was approaching a heater in another room to shut it off when an explosion occurred. The building was demolished and the janitor and maid were seriously injured. Two children outside were trapped under the falling roof but escaped injury.

Investigators do not believe that the small leak detected by the janitor was the source of the large volume of gas in the building. It is their opinion that it came from a break in a street main.

Auto Sales and Service, Portland, Ore., Feb. 14, 1956. $10,000

The basement, sidewalk and first story walls were damaged by an explosion that occurred when two employees entered a parts storage area beneath the sidewalk and pulled the light chain. Following the explosion fire burned at cracks in the basement wall. The fire, as well as the explosion, was found to have involved gas escaping from an 8-in. high pressure distribution main in the street about 24 feet from the building.

Dwelling, near Scotia, N. Y., Feb. 25, 1956. $8,000; 2 killed

One man was killed by a gas explosion that occurred while he was in the basement repairing his cigarette lighter. The other fatality involved a fire fighter who was poisoned by smoke while fighting the ensuing fire in this 2-story wooden dwelling.

Although there were no gas connections to the dwelling, investigators concluded, after discovering a leak in a natural gas street main 80 feet away, that the explosion involved natural gas that had spread beneath the ground to the basement of the dwelling.

Bank, East York, Ont., March 5, 1956. $10,000

A gas explosion damaged the basement of the 1-story brick, wood-joisted building when an employee in the stationery storage room lighted a cigarette. The gas came from a break in an 8-in. street main 150 feet from the building and probably followed an underground telephone cable duct into the building.

Wide World

Gas from a ruptured 10-inch cast iron feeder main under 14 pounds pressure entered the basement of this dwelling at Flint, Mich., where an explosion occurred on March 20, 1956.

Dwelling, Flint, Mich., March 20, 1956. $16,000

A gas explosion in the basement at 4:55 A.M. did considerable structural damage to the 2-story wooden building and was followed by fire that completed the destruction. Of the six occupants, two who slept in the basement were critically burned.

A 10-in. cast iron feeder main in the street carrying natural gas at 14 psi pressure and running parallel to a 4-in. domestic service main had ruptured. Investigators concluded that gas had spread beneath the ground to the basement where it was ignited by one of two gas burning appliances.

Fire Alarm Box, Sterling, Ill., May 7, 1956

Twice within a week the lock on a fire alarm box was found broken and the door open. On discovery of a leaking bell joint on a 6-in. gas distribution pipe near the alarm box investigators concluded that gas had followed a conduit pipe from the ground to the box where an explosive gas-air mixture formed that was apparently ignited by an electric spark.

Gas Distributing Pipe, Salt Lake City, Utah, May 14, 1956; 2 killed

Two workmen were killed and four were injured by an explosion of natural gas escaping from a gas distribution pipe. The workmen were remodeling the main when the explosion occurred.

Store and Apartment, Middletown, Ohio, Sept. 3, 1956. $23,000

Six of the ten occupants of the first story were injured when a gas explosion severely damaged the 2-story wooden building. Investigation revealed that a 6-in. gas main in the street had a break and that occupants of the store had smelled gas for two days prior to the explosion. Recent sewer construction work in the street may have caused the gas main to settle and crack.

Tavern, Boston, Mass., Dec. 4, 1956. $100,000

A gas explosion in a 1-story brick, wood-joisted tavern demolished the tavern and so badly damaged an adjoining 4-story building that it was ordered razed. Windows in many other buildings within a radius of a quarter of a mile were broken. Discovery of a broken 8-inch main in the street in front of the rubble of the 1-story building suggested that the gas had escaped from the break and flowed through the ground to the unoccupied tavern.

Brush, Cosmetic and Insecticide Warehouse, St. Paul, Minn., Jan. 14, 1957. $500,000; 1 killed

Fire that destroyed the 135 ft. by 65 ft. 2-story brick, wood-joisted warehouse followed a gas explosion in a basement storage room. The explosion occurred when the foreman of a crew installing an automatic sprinkler system lighted his cigarette lighter. Cartons of brushes, boxes of insecticide bombs, spot removers, drums of floor wax and other combustible contents created an intense fire that burned for seven hours before being controlled.

It was the consensus that the gas leaked from a gas distribution pipe three feet below ground level. This pipe apparently had been damaged in some way when a large water pipe to supply the sprinkler system was installed six feet below ground level and directly beneath the gas pipe.

A fireman suffered a fatal heart attack while fighting the fire.

Stores and Dwellings, West Peoria, Ill., Jan. 16, 1957. $270,000; 4 killed

Two gas explosions, about a minute apart, demolished two adjacent 2-story brick buildings, killed four occupants and injured eleven others. Twelve exposed buildings received varying degrees of explosion and fire damage.

Twenty minutes before the explosions an occupant of one of the demolished buildings had called the gas company to report escaping gas. Gas company employees were on the way to the scene when the explosions occurred. The source of the escaping gas was found to be a break a little less than one-eighth of an inch in width around the circumference of a 12-in. street main.

Hardware Store, Roselle, Ill., Jan. 28, 1957. $300,000; 7 killed

At 11:00 A.M., while a power auger was being used to set an electric light pole, the auger damaged a 1¼-in. distribution pipe carrying natural gas at 20 psi pressure. The pole setting crew quickly refilled the hole in the ground and notified the gas company.

Wide World

Seven persons were killed by a gas explosion in this hardware store at Roselle, Ill., on Jan. 28, 1957. The gas came from a leaking distribution pipe that had been damaged by the auger being used by a pole setting crew.

Walt Mulcahy

Five downtown buildings in Reno, Nev. were destroyed by two almost simultaneous explosions on Feb. 5, 1957. That only two persons were killed was due to the fact that everyone had been ordered out of the buildings by gas company and fire department personnel 18 minutes before the explosions occurred.

Gas spread beneath the ground to the basement of an adjacent 2-story brick, wood-joisted building where an explosion occurred at 11:30 A.M. Seven occupants of the building were killed, nine were injured and the building was demolished. Windows were broken within a radius of 1,000 feet.

Stores and Offices, Reno, Nev., Feb. 5, 1957. $2,000,000; 2 killed

Two people were killed and 45 were injured when two almost simultaneous explosions (followed by fire) destroyed five downtown 1- and 2-story masonry, steel- and wood-joisted buildings. Ensuing fire also caused considerable damage to another 3-story brick mercantile building. Extensive damage to plate glass windows occurred within a 600 ft. radius.

At approximately 12:45 P.M. gas company and fire department representatives who were on the scene investigating a reported odor of gas in one of the buildings decided that the buildings in the area should be evacuated. The explosions occurred at 1:03 P.M. One of the two victims was on the sidewalk; the other had re-entered a building and was just stepping outside when the explosions occurred.

Following the explosions a break was discovered in a 2-in. propane-air distribution main in the street. Whether the break occurred before or after the explosions had not as yet been determined.

Dwelling, Wauwatosa, Wis., Feb. 18, 1957

United Press

An explosion reported to have been caused by leakage of natural gas entering the basement through a newly installed sewer line destroyed this dwelling. Four occupants of the house escaped unharmed. Ignition of the gas was thought to have been from the oil-fired furnace in the basement. Several small fires in the basement after the explosion were extinguished by the fire department.

Storm Sewer, Montreal, Que., March 5, 1957

Five firemen who had been called to fight "fire in a manhole" were burned when flames burst from the storm sewer manhole. Three explosions in the storm sewer tossed manhole covers into the air, ripped up the street and broke windows of exposed buildings. The fire and explosions involved gas that had entered the sewer from a leaking gas distribution pipe in the street. Two hundred occupants of neighboring buildings were evacuated until the leak was stopped and it was determined that it was safe for them to return.

Service Piping to Buildings

Dwelling, Vincennes, Ind., Jan. 12, 1950. $30,000; 5 killed

Five occupants of this 1-story masonry, wood-joisted dwelling were killed when a natural gas explosion demolished the building. Investigators found a hole in the gas service pipe three feet from the basement. The pipe had been covered with cinders for about ten years.

Dwelling, Port Washington, N. Y., May 3, 1950. $21,000

A new 2-story wood-framed, brick veneered dwelling was destroyed by a gas explosion and resulting fire that occurred when a bulldozer grading a new street beside the house snagged the gas service pipe. The pipe was pulled loose at the service regulator in the cellar permitting high pressure gas to escape. Hearing the hiss of escaping gas the woman of the house left with her 4-year-old daughter minutes before the explosion occurred.

Tavern, Joliet, Ill., May 29, 1950; 2 killed

In the process of removing an abandoned underground gasoline tank, a tractor struck the gas service line to a nearby building and caused various gas leaks in the piping. About 10 minutes after the gas company had repaired the line an explosion occurred that demolished the wooden building and started a fire in the basement. The fire went out when the gas was shut off. Two men in the building at the time of the blast were killed.

Stores and Clothing Factory, Seattle, Wash., July 14, 1950. $165,000; 1 killed

Wide World

One occupant of this 3-story brick, wood-joisted building was killed and 12 were injured by an explosion of gas that originated in the basement. The gas had entered the building from a corroded 2-in. gas service pipe. An electric motor on a walk-in refrigerator was the ignition source.

Hotel, Leduc, Alta., Nov., 11, 1950. $100,500; 10 killed

During installation of a gas distribution system in Leduc a gas explosion demolished a 2-story brick, wood-joisted hotel. The more than 25 occupants of the building were injured, 10 fatally. A 2-in. gas service pipe had been installed between the distribution pipe and the basement of the building. The building end was uncapped and the curb shutoff cock was left in the open position. The explosion occurred during a test of the completed distribution system and about 15 minutes after gas had been allowed to flow into the system.

Wholesale Fruit Warehouse, New Castle, Pa., Dec. 26, 1950. $145,000

A violent explosion blew out the sides and front of the 1-story brick, wood-joisted building shortly after employees reported for work following a 2-day holiday. Three employees were hospitalized with burns. The explosion occurred when one of the employees entered a cooler and lit a cigarette. Since the gas meter was located in the cooler, it was the opinion of the fire chief that the explosion involved escaping gas. Crates of vegetables piled around the meter had evidentally bumped against it and loosened a connection.

Glass Factory, Glassport, Pa., May 15, 1951. $176,800

A defective underground gas service pipe was thought to be the source of gas that entered the basement of the 2-story brick, wood-joisted building where it exploded. Several employees were hospitalized as the explosion extended up through the building damaging the first and second floors, blowing out part of a first story wall, breaking a sprinkler main and shattering windows and glass stock. The flash fire that broke out was fought with extinguishers and standpipe hoses by employees, (all of whom were members of the local fire department) and had been practically extinguished when the fire department arrived.

During the three months preceding the explosion gas had been smelled in the basement, but efforts of employees to locate the leak had not been successful. Following the explosion a compressed air test on a 6-in. service pipe to the lehrs revealed a leak at a 3-in. reducer.

Dwelling, Greece, N. Y., July 30, 1951. $22,000

A power shovel working in the street snagged the 2-in. service pipe to the 1-story wooden dwelling and pulled it loose from the meter in the basement. The shovel operator immediately warned all occupants of the dwelling to leave. Fortunately they followed his advice at once, since the building was demolished by a gas explosion about three minutes later.

Dwelling, Colorado Springs, Colo., Aug. 4, 1951. $5,000; 1 killed

A gas explosion in the basement of this 1-story wooden dwelling took the life of a 6-year-old girl and severely injured the other four members of the family. The explosion occurred after a basement foundation caved in and broke the gas service piping at the meter which was attached to the wall. Heavy rains had occurred for several hours preceding the cave-in. The fact that the basement had been dug several years after the building had been erected may have been a factor in the wall collapse.

Bank, Farmingdale, N. Y., Feb. 13, 1952. $40,000; 2 killed

Two persons in the bank were killed and eight were injured when a gas explosion in the cellar demolished the 1-story masonry, wood-joisted building. The gas entered the building from a break in the gas service line to a restaurant across the street. The service pipe passed near one side of the bank and was being exposed by a contractor's crew looking for a gas leak at the time of the explosion. Reports indicate that a ditch-digging machine broke the service pipe.

Dwelling, St. Paul, Minn., Aug. 27, 1952

Associated Press

Three persons were injured, one dwelling was wrecked and three adjacent dwellings damaged by a gas explosion in the wrecked building. A break in the gas service line caused by removal of three tree stumps was believed responsible for the gas accumulation in the dwelling.

Dwelling, Pittsburgh, Pa., Dec. 5, 1952, $10,000; 6 killed

Six children perished in a gas explosion that demolished the 3-story wooden dwelling in which they slept. Their parents were able to escape. The explosion occurred after an automobile skidded off the street during a heavy rain storm and struck the gas service pipe where it extended from the ground to the gas meter on the outside of the house.

Restaurant, Racine, Wis., Aug. 25, 1953. $55,000

Explosive ignition of natural gas at 11:12 P.M. was followed by fire that destroyed the 1-story wooden building. In the early afternoon an excavating machine had broken a natural gas service pipe, releasing gas that seeped into the building. The gas company was notified immediately but before service men arrived the gas in the building ignited, probably at a gas-fired water heater.

Dwellings, Camp Hill, Pa., Dec. 17, 1953. $43,400

Wide World

A gas explosion in the basement blew out one wall of the 2-story wooden dwelling, injured two occupants and set fire that destroyed the building of origin and two exposed wooden dwellings, one on either side.

On the day preceding the fire the sidewalk in front of the buildings had been broken by a heavy weight and had been removed by a power shovel. Investigators found that the gas service pipe to one of the exposed dwellings had been separated from the 3¼-in. distribution pipe just beneath the surface of the ground where the sidewalk had formerly been located. The still-connected gas service pipe to the dwelling where the explosion occurred passed through the ground at the site of the separation.

Dwelling, Taylor Twp., Mich., April 25, 1955. $10,500

An auger being used to make a hole for an electric light pole snagged a gas pipe and pulled it loose at the meter in the basement of an adjacent dwelling. The dwelling was severely damaged when the escaping gas exploded.

Dwelling, Des Moines, Iowa, March 23, 1956. $18,000

Failure of gas company employees to follow the company's established safety rules was probably responsible for the gas explosion that destroyed a dwelling and damaged a dwelling on one side and a restaurant on the

Wide World

Seven persons were killed in a gas explosion in this apartment house at Ville La Salle, P. Q., on Aug. 28, 1956. Ten minutes earlier the gas service pipe to the building had been broken by a bulldozer being used to level ground for a sidewalk.

other. Company practice when installing a gas service pipe was to install a shutoff cock on the customer end of the pipe, put a threaded cap on the pipe and to test for leaks with air pressure. In this installation the air pressure test was not made, the pipe was not capped and the shutoff cock was left in the "on" position. Consequently, gas entered the house when the pipe installing crew opened the valve at the junction of the distribution and service pipes.

Apartment House, Ville La Salle, Que., Aug. 28, 1956; 7 killed

Seven occupants of this recently built 2-story brick, wood-joisted building were killed when a gas explosion ripped the building apart. Newspaper reports state that 10 minutes earlier a bulldozer operator had advised the building occupants that he had broken a gas service pipe while leveling ground for a sidewalk and had warned them not to use their stoves.

Prior to starting work on the sidewalk contract the contractor reportedly made inquiries of the public gas utility concerning the depth of gas service pipes. The information apparently could not be given him although he was told that the gas distribution pipe was four feet down.

Meat Packing Plant, Glenwood, Iowa, Oct. 10, 1956. $125,000

At 6:15 A.M., as the day's operations were about to start, a gas explosion occurred in a basement locker room. Four employees were hospitalized and the 1-story masonry, wood-joisted building was severely damaged. No fire ensued. At 3:00 P.M. October 9, the plant management notified the gas company that there was a strong odor of gas, and the plant watchman thought the situation so serious at 5:30 A.M. the following morning that he telephoned a gas company executive at his home.

Following the explosion investigators discovered a leak in a gas service pipe at a point in the yard where the main crossed a sewer pipe. It is their opinion that leaking gas followed the sewer pipe into the building where it was ignited when an employee lit a match or threw a light switch.

Dwelling, Salem, Ore., Nov. 21, 1956

About 9:40 A.M. the father of the 3-member family took a cup of coffee to the living room, sat down and prepared to light a cigarette. As he struck the match a gas explosion occurred that practically demolished the 1-story wooden dwelling and injured all members of the family.

Investigators learned that gas had been installed in the residence in 1930; that the service had been discontinued in 1939; that the curb cock had been closed in 1953 or 1954, and that the gas service had been reactivated on Nov. 19, 1957 when a gas-fired floor furnace had been installed. No test had been made of the gas service pipe before the service was reactivated. Examination of the service pipe revealed general deterioration due to rust and the presence of three holes in the pipe, the largest an oval ½ in. by ¾ in. and located 91 inches from the basement.

Military Tank Garage, near Calgary, Alta., Nov. 27, 1956. $2,150,000

A mechanical digging machine excavating for a manhole 6 feet from the 240 ft. by 80 ft. 1-story masonry, wood-joisted building snagged and broke a natural gas service pipe. Gas escaping under 10 pounds pressure from the 2-in. pipe entered the building and exploded 15 minutes after the break occurred. Fire that immediately involved the interior continued to burn until the building and its contents were destroyed.

Dwelling, West Boylston, Mass., March 5, 1957

A contractor who had been hired by the homeowner to dig up and prepare a sewerage leeching bed broke the gas service pipe to the dwelling. All occupants were away at the time. Gas utility employees were called and were on the premises trying to stop the leak when gas that had seeped into the basement was exploded by an arc or spark at a thermostatic control on an electric hot water heater.

The contractor had not gotten in touch with the gas company relative to location of service piping before starting the work.

Transmission Piping

Farm Buildings, Sarahsville, Ohio, Jan. 20, 1950

Failure in a section of this gas transmission pipeline at 3:15 A.M. caused an explosion that blew a crater 14 feet deep and 20 feet in diameter. Sparks from flying debris probably ignited the escaping gas-air mixture that burned for three hours until the gas supply was shut off. Fire destroyed an unoccupied farm house and five smaller outbuildings.

Farm Buildings, near Beallsville, Ohio, July 1, 1950

At 9:30 P.M. an explosion caused by failure of this 20-in. gas transmission pipeline shot flames 200 feet in the air and destroyed a house, barn and several outbuildings in southeastern Ohio. Firemen were credited with saving several other nearby houses from burning by prompt use of hose streams.

Dwellings, King of Prussia, Pa., Nov. 23, 1950

Apparently while testing a new 30-in. gas transmission pipeline a failure occurred accompanied by an explosion that ripped up nearly 3000 feet of pipe. The resulting fire destroyed two partly completed homes. No one was injured. The spectacular 500-ft.-high column of flame and smoke from the fire burned out quickly as control valves were immediately closed, shutting off flow of gas.

Dwelling, Garage and Barns, Refuge, Miss., Dec. 4, 1950; 2 killed

Two persons were killed and three seriously burned in an explosion and fire when a failure occurred in a 30-in. gas transmission pipeline operating at 400 pounds pressure. A frame dwelling, garage and three barns were also destroyed.

Cause of the fire was reported as a failure in a section of pipe about eight miles distant from a compressor station. Fire fighting operations were handicapped by the lack of water. Firemen were able to save a small nearby building and a large farm machinery shed in the area.

It was reported that all combustible material within 300 feet of the break was ignited instantly due to the intense heat of the fire. Flames, reported to have been 150 – 200 feet in height, continued to burn for some time until gas was shut off.

Autos and Buildings, St. Louis, Mo., Jan. 29, 1951

Gas seeping from a broken section of a 6-in. feeder main was apparently ignited by a passing auto in a suburban section of St. Louis during near zero weather. Several occupants of passing cars were badly burned as they abandoned their cars when the blast occurred at 6:30 P.M. Several small buildings and autos in a nearby used car lot were destroyed by the fire. Fire burned for about three hours

as gas company employees had difficulty in locating the shutoff valves due to ice, snow and frozen ground.

Dwelling, near Uniontown, Pa., Nov. 27, 1951

Three explosions of gas escaping from a break in a 12-in. pipeline were followed by fire that involved a 30-acre area, destroying a dwelling 100 feet from the break, as well as equipment used in construction of a gas pumping station. Fortunately the break occurred at 12:25 P.M. when the 115 workmen were at lunch. Pipeline valves about 10 miles away were closed at 1:45 P.M. Approximately 45 minutes later the fire went out.

near Greenville, Miss., Mar. 10, 1952

A break occurred in an 18-in. gas transmission pipeline operating at 400 pounds pressure near a fairgrounds outside Greenville with a tremendous roar at 6:15 A.M. Fortunately the escaping gas was not ignited and the line was shut off about 45 minutes after the break occurred. Prompt closure of the block valves very likely avoided a more serious incident.

Marietta, Pa., May 17, 1952

A newly installed valve split wide open while workmen were restoring pressure to a temporary section of the aboveground gas transmission pipe during construction of a compressor station on the "Little Inch" pipeline. Six men were injured by the explosion, two seriously. No fire occurred. The line was immediately shut off after the blowout. Traffic in the vicinity was diverted for about four hours as a safety precaution.

near Dawn, Texas, June 11, 1952

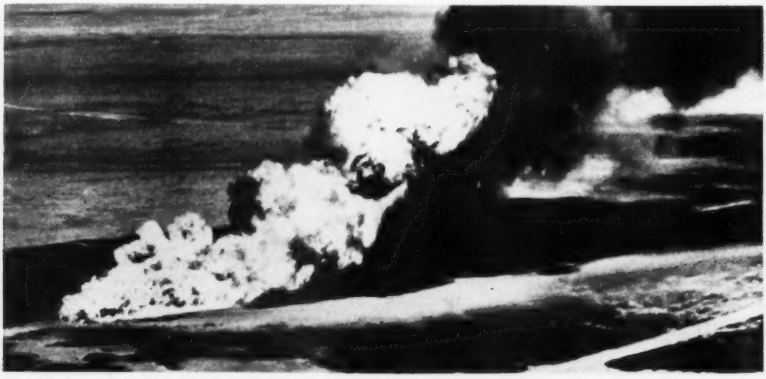
A break occurred in a 25-in. gas transmission pipeline causing an explosion and fire. Fire burned for more than two hours until the gas was shut off.

near York, Pa., July 9, 1952

A break in the "Little Inch" gas transmission pipeline set off a fire in a farming section near York that burned for about 3 hours. Gas was shut off in this line about 1½-hours after the explosion. No one was injured and no property damage was reported.

near Carmichaels, Pa., Oct. 18, 1953

An explosion and fire occurred in a 30-in. gas transmission pipeline operating at 750 pounds pressure. Apparently a defect in the piping caused a rupture and resultant whipping of the line broke a section of piping scattering earth and stones over a wide area. Ignition of escaping gas was probably caused by mechanical sparks from flying debris. No casualties or property damage was reported. The flow of gas was shut off and the fire was extinguished within a short time.



United Press

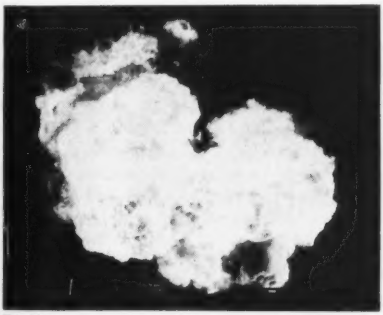
A break occurred in a 25-inch gas transmission line near Dawn, Texas on June 11, 1952. Escaping gas exploded and fire burned for two hours until valves were closed.

Farm and Gas Utility Buildings, near Horseheads, N. Y., Dec. 16, 1953

Failure of a section of pipe in a 20-in. underground natural gas transmission pipeline caused an explosion with injury to one man. Two utility company buildings and three farm buildings were destroyed in the fire that followed.

At about 9:50 P.M., just as gas company employees completed work in a gas regulator building and were leaving the premises, a failure occurred in the incoming transmission pipeline near the station. Escaping gas at 400 pounds pressure blew through the ground scattering debris over a wide area. Gas was probably ignited when one of the workmen started his car parked in the area. Fire burned for some time until the gas company closed valves on the main transmission line 6 and 12 miles distant.

Dwelling, near Lawrence, Kan., Jan. 14, 1954



United Press

A mother and her two children escaped through the window of their blazing home as flames from a gas pipeline failure destroyed the house. An explosion due to a failure in a gas transmission pipeline followed by a fire completely destroyed this farm house (concealed by flames in the photo) near Lawrence, Kansas.

Shopping Centre, near Lexington, Ky., Mar. 18, 1954. $125,000

Two of eight stores in a 1-story building were destroyed and the others, as well as an adjacent garage, were damaged by fire that followed explosive ignition of gas escaping from a 12-in. natural gas transmission main. Originally laid in 1913, the main was being relocated to permit construction of more buildings at a new development and was being tested under 100 psi gas pressure when a new section of pipe slipped out of a Dresser coupling. Rocks and dirt were blown out of the open trench by the escaping gas, breaking windows in the stores 25 feet away. Most of the buildings were evacuated within one or two minutes before the explosion occurred. Although the valve 10 miles upstream was closed at once, gas continued to discharge into the fire area for about 15 minutes.

near Clendenin, W. Va., Jan. 27, 1955; 2 killed

Two workmen were killed and three others seriously injured in an explosion while repairing a leak in a 16-in. gas transmission pipeline. No fire occurred. Apparently the workmen were just starting to repair a leak at a bend in the pipe when the failure occurred. The blast ruptured a 4-ft. section of pipe hurling earth and stones over a wide area.

Liberty Twp., Ind., Mar. 9, 1955; 5 killed

Five men were killed and two were seriously injured while working on a project to relocate a gas transmission pipeline due to the construction of the Indiana Turnpike. Apparently the utility company had relocated approximately 2500 ft. of 22-in. pipe and the line had been in operation several days. Work had been completed except for backfilling a small portion of the line when the explosion occurred. Examination of the pipe revealed a break in a weld-end coupling that joined the relocated line to the original line. The exact cause of this break has not been determined. It was reported that bulldozers were used in the backfilling operations and possibly could have damaged the pipe. Leaking gas was believed to have been ignited from a flare used for traffic safety.

near Herscher, Ill., Mar. 9, 1956. $10,000

Failure of an underground 30-in. main gas transmission line operating at 750 pounds pressure was attributed to a fault in the weld at a transition ring in the pipe where the pipe wall thickness was increased for a road crossing. The failure caused damage to approximately 45 feet of pipeline, tearing it out of the ground and hurling debris over a wide area. Escaping gas was probably ignited from frictional sparks caused by flying debris. Fire burned for about 45 minutes until gas was shut off.

East Berlin, Pa., Jan. 23, 1957

Failure in a section of the 20-in. gas transmission sent flaming gas 200 feet in the air at a point four miles north of East Berlin, Pa. No injuries or damage other than to the pipeline were reported. Escaping gas was believed ignited by a mechanical spark when failure occurred.

Building Piping

Restaurant, Cincinnati, Ohio, Apr. 7, 1951; 3 killed

As a result of a reported gas leak in this building, the utility company sealed the meter pending repairs. An occupant of a third floor apartment broke the seal and turned on the gas so he could use his gas stove. Gas accumulated in a lavatory on the first floor and when a waitress, employed by the first floor restaurant, lit a cigarette a gas explosion occurred. Three occupants of the restaurant were fatally injured in the explosion.

Building Under Construction, Dover, Ohio, May 22, 1952. $100,000

During the completion of an addition to the laboratory at this hospital, the gas pipes were bled of air and the burners lighted. Soon after this test had been completed a gas explosion severely damaged the new addition. Investigation after the explosion revealed a 1¼-in. gas pipe in the hallway to the addition that had not been capped. Fire following the explosion involved only the gas escaping from the uncapped pipe. Ignition source of the gas is unknown.

Employee's Dormitory, McKees Rocks, Pa., Sept. 25, 1954. $9,000; 5 killed

Five men were killed and four received nonfatal burns when natural gas exploded in the 1-story wooden dormitory. The gas escaped from a broken pipe supplying fuel to a gas-fired floor furnace. Although investigation did not reveal conclusive evidence as to the cause of the leak, it is known that the pipe was not protected against mechanical injury where it passed through a room in the building. Gas had been smelled by an occupant for a short time preceding the explosion.

Department Store, River Forest, Ill., March 6, 1955. $125,000; 5 killed

While a new oven was being installed in the bakery area of a 3-story sprinklered fire-resistive department store, a gas explosion occurred in a 40-in.-high concealed space beneath the reinforced concrete floor. Five men in the area were killed by the blast.

River Forest Police Dept.

Gas entered the concealed space from a pipe that had supplied the old oven. The pipe had been cut off beneath the floor but had not been capped. The explosion occurred when the gas supply to the bakery area was turned on. The ignition source is unknown.

Food Processing, Oklahoma City, Okla., Dec. 24, 1955. $89,000; 1 killed

A gas explosion in an underfloor crawl space beneath this 2-story brick, wood-joisted produce company building demolished the building of origin and two adjacent 1-story buildings of similar construction. One employee of the produce company was fatally injured in the explosion and 19 other employees received varying degrees of injuries.

A thorough investigation following the explosion did not reveal the source of the gas that leaked into the crawl space. Gas piping in that area had been checked with a meter check by the gas utility company during the month prior to the month of the explosion. This check was done in connection with the testing of a new street main that had been installed. The ignition source was established as a gas-fired floor furnace.

Dwelling, Columbus, Ohio, Jan. 24, 1956

Two occupants of this 2-story wooden dwelling were injured and the house suffered severe structural damage from a gas explosion in the basement. Gas apparently escaped from one of two unapproved valves added by the owner. When the furnace door was opened the explosion occurred.

Wholesale Meat Distributor, Toledo, Ohio, Feb. 13, 1956. $280,000; 3 killed

Three men were killed and five adjoining brick, wood-joisted buildings were destroyed by an explosion in a 3-story building occupied by a wholesale meat distributor. Fire officials believe the explosion involved gas that escaped in an adjoining vacant building after gas piping had been stolen. Gas service to the vacant building had not been shut off at the curb since a manifold in the basement served an occupant of an adjoining building. The stolen pipe was from the property side of the customer's service pipe carrying gas to the three-meter manifold. Fire officials believe that the gas filled the building of origin and the adjoining wholesale meat building before it was ignited by a space heater on the first floor of the latter building.

Shoe Factory, Montreal, P. Q., May 9, 1956. $42,000

A 10 ft. by 35 ft. wooden enclosed area on the second floor of the 4-story masonry building contained a lavatory, a gas-fired hot water heater, a charging door to an incinerator chimney that extended through the roof of the building, and an opening in the ceiling to a light well that also extended through the roof. The gas-fired water heater had been shut off at the gas cock but the cock apparently leaked. Gas escaped into the enclosure and was ignited explosively, probably by a spark from the incinerator charging door.

The watchman heard the explosion and on investigating found the wooden enclosure burning. Two sprinklers outside the enclosure operated on the second floor and one head fused on the third floor. Firemen were summoned by the central-station-connected waterflow alarm. The explosion broke windows in the light shaft, and severely damaged the water heater.

Plumbing and Heating Equipment Warehouse, Dayton, Ohio, July 28, 1956. $80,000

Gas escaping from broken piping in the boiler room exploded, resulting in about $70,000 explosion damage to the 1-and 2-story brick, wood-joisted building of origin and exposed structures and $10,000 damage from the ensuing fire.

The building was closed at the time of the explosion. Responding to an outsider's alarm at 2:15 P.M., firemen found one wall of a new addition to the building blown out and a large section of the roof blown off. Fire following the explosion was extinguished in about 30 minutes. Many windows in a large warehouse about 50 feet away were shattered.

Wide World

An hour after classes were dismissed from this school at Donnelsville, Ohio on Sept. 7, 1956 a gas explosion practically demolished a new 6-room addition. For three days prior to the explosion the odor of gas had been noted.

Public School, Donnelsville, Ohio, Sept. 7, 1956. $171,000

An hour after classes were dismissed for the day a gas explosion practically demolished the new 6-room, 1-story masonry, steel-framed addition. The explosion was centered in the kitchen and apparently involved gas that escaped from piping on newly installed cooking and refrigerating appliances. For three days before the explosion the odor of gas had been noted. School personnel were assured that everything was all right by an equipment installer and a gas company employee.

Apartment House, San Francisco, Calif., Jan. 6, 1957

This 3-story apartment house was wrecked, an adjoining dwelling damaged and seven persons were critically injured in a gas explosion that was initiated when an occupant of the apartment house lit a cigarette. Preparatory to painting one of the apartments, the gas appliances had been removed and the open gas pipes plugged. One of the plugs was defective and allowed the gas to escape.

Public Utility Garage and Warehouse, Oakland, Calif., Jan. 23, 1957. $300,000; 2 killed

A plumber hired to install three gas heaters uncapped a 2-in. high pressure (30 psi) pipe without first closing a valve on the pipe. The cap flew out of his hand, gas escaped, formed an explosive mixture with the air in the building and exploded on reaching an ignition source. Two employees were trapped and killed in the second story when flames flashed up an open stairway. Four were injured.

The fire department report states that it is apparently accepted practice for plumbers to work on gas pipes without closing the valve.

Dormitory Under Construction, Kalamazoo, Mich., Jan. 25, 1957. $65,000

Two employees installing a clothes drier in a second story utility room were injured and the 2-story brick, wood-joisted building was severely damaged by an explosion that occurred when one of the men struck a match to light a cigarette at 9:12 A.M. The explosion involved gas that escaped from an uncapped ¾-in. gas supply pipe in the utility room.

United Press

Investigators learned that 24 hours before the explosion a gas company employee, after checking all pilot lights in the building, had turned on the gas to the building. However, he could not check for leakage by a meter test since the meter served several apartments. A month prior to the explosion the piping had been tested for tightness. Subsequently an unknown person had removed the cap.

Appliance Store, Los Angeles, Calif., March 6, 1957. $100,000

A passerby had spent a few minutes looking in this appliance store window and had just walked away from the 1- and 2-story brick, wood-joisted building when an explosion blew out the front windows. Fire following the explosion immediately involved the interior of the building. Firemen received the first alarm at 6:07 A.M.

Since repair work had been done on the gas meters in the building on the day preceding the explosion it has been theorized that a gas leak resulted from the repair work. The gas could have been ignited by a pilot light on a hot water heater near the front of the store.

Appliances

Industrial

Building Under Construction, Edmonton, Alta., March 16, 1951. $125,000

Fire that destroyed this 1-story brick, wood-joisted school under construction originated in a classroom where an improvised gas-fired heater had been set up to dry plaster. The heater consisted of a metal drum set upright on short legs, into the bottom of which ran a small gas pipe. The end of the pipe was flattened to reduce the opening. Air for combustion came through holes punched in the bottom of the drum. A stovepipe ran horizontally from the drum through a gypsum

board window covering and then vertically to above the roof. There was no damper in the smoke pipe.

Investigators believe high winds caused a down draft in the chimney which in turn prevented an adequate air supply from entering through the holes in the bottom of the drum. (In this setup combustion air had to come through the holes.) With an inadequate air supply a gas-air mixture is believed to have formed in the drum that was ignited explosively by a hot surface of the drum. Sawdust that had been spread on the floor (except in the immediate vicinity of the drum) may have been ignited by the explosion.

Jewelry Factory, Providence, R. I., Apr. 20, 1951

To prevent discoloration of metal strips while being annealed in an electric annealing furnace, the products of combustion of city gas were passed into the furnace by means of a pipe from a gas burner. When unburned gas was accidentally passed into the furnace at the start of operations an explosion occurred inside the furnace.

Bakery, New Bedford, Mass., June 22, 1951. $1,100

A gas explosion in the modern, automatic temperature controlled oven blew off the charging door, caused other structural damage to the oven and broke a window 30 feet away. No fire ensued but bakery stock was damaged by soot.

The explosion occurred when the attendant relighted the oven after the pilot light had gone out. On being notified by visual and audible signals that the pilot was out, the attendant had shut off the gas and opened the oven door to purge the oven of any gas that may have accumulated inside. Apparently, however, foreign material had lodged under the seat of the automatic gas control valve, preventing it from being completely closed.

Meat Packing, Alexandria, La., Nov. 27, 1951; 1 killed

The smokehouse operator was fatally injured in an explosion that occurred while he was lighting the smokehouse gas burners. Apparently he turned on the gas to the burners and then delayed pushing the electric ignition switch button several minutes, during which time the smokehouse filled with an explosive gas-air mixture.

Box Factory, Bridgeport, Conn., Oct. 17, 1952. $9,600

A gas explosion in the firebox of one of two oil-fired boilers blew the doors and insulation off the boiler, broke piping and damaged the walls and roof of the boiler room.

In order to ignite the oil burner in the boiler an electric spark ignited a gas jet, normally turned off, which in turn ignited the fuel oil. The explosion occurred at the time when the city gas system was being changed from manufactured to natural gas, a change that required adjustment of practically all gas burning devices in the city. The gas igniter burners had not been adjusted, suggesting that delayed ignition had permitted the firebox to fill with an explosive gas-air mixture before ignition.

Cloth Embossing Works, Griswold, Conn., Nov. 27, 1952. $5,000

The drier roll on an embosser was heated by gas burning at a perforated pipe inside the drier roll. Apparently an employee when lighting the burner allowed the roll to become filled with an explosive mixture before inserting the lighter, since an explosion occurred when he inserted it. The explosion ignited the combustible exhaust ducts common to this and another embosser.

Aluminum Foundry, Bedford, Ind., Apr. 6, 1954. $170,000

Before the lunch hour the three 2½-in. gate valves on gas piping to burners for the core oven were closed. Circulating fans, exhaust fans and pilot lights were left operating. At 12:30 P.M., when the oven heaters were restored to service, the temperature did not increase and at 12:58 P.M. a severe explosion occurred in the 230 ft. by 10 ft. by 12-ft.-high oven. Seven employees were injured. The oven was severely damaged, most of the glass in building walls and monitors was blown out and a 400-ft. section of the roof was raised.

Evidence indicates that failure of one of the dampers to modulate in the gas and air proportioning equipment allowed unburned gas to enter the oven.

Dog Biscuit Bakery, Los Angeles, Calif., Dec. 20, 1954. $300,000

A gas explosion in a vent from one of the 116-ft.-long conveyor type ovens in the building preceded fire that broke out beneath

International

Absence of flame failure safeguards at oven burners and lack of adequate oven ventilation resulted in an explosion and fire on Dec. 20, 1954 that destroyed this Los Angeles, Calif. bakery.

the wood roof in the vicinity of the vent. Had the building been sprinklered or had the fire department been called at once it is probable that the fire would have been controlled with minor damage. On discovering the fire, employees discharged several fire extinguishers without effect before calling the fire department. This delay allowed the fire to involve shortening oil, flour dust and waxed paper, and to spread rapidly through the undivided 172 ft. by 96 ft. 1-story masonry, wood-joisted building.

The explosion is attributed to the absence of flame failure safeguards at each burner and the absence of an adequate oven ventilating system.

Bakery, Mason City, Iowa, Jan. 31, 1955. $27,700

At 2:55 P.M. the baker lit the gas-fired oven as usual. At 3:03 P.M. an explosion occurred in the oven that ruptured the oven, blew out windows and moved one wall of the 2-story brick, wood-joisted building about 6 inches. Fire that ensued was in an unsprinklered motor enclosure and was quickly put out by firemen using a pump tank extinguisher. Cause of the explosion is undetermined. The oven was not equipped with modern, fully automatic controls.

Bakery, Baltimore, Md., April 28, 1955. $50,000

Fifteen minutes after the indirect gas-fired baking oven was started up for the day's operations a gas explosion practically demolished the oven, stunned employees, blew out building windows and lifted a section of the roof. Small fires that broke out in dust were quickly extinguished by water from 21 sprinklers fused by the heat from the ruptured oven.

The explosion must have been preceded by ignition failure, but the reason for this failure could not be determined because of the extent of damage. The oven was said to have been equipped with all the usual safety devices for flame and heat control. The exhaust fan was in working order after the explosion. The most probable reason for an explosive gas mixture in the oven was too short a purge period between flame failure and reignition.

Hardwood Flooring and Stave Mill, Clarksville, Ark., May 4, 1957. $8,500

Three adjoining gas-heated wooden dry kilns were damaged by fire that followed a gas explosion in the gas burner tunnel (masonry walls, metal top) beneath one of the

kilns. High winds are believed to have extinguished one or more burners. Gas escaped into the tunnel and on reaching an explosive concentration ignited at one of the still lighted burners. Sprinklers operated but because of poor water supplies were unable to control the fire that broke out in the kiln following the explosion.

Reconstruction of the kiln included installation of an inverted U trough above the burners. The purpose of the trough is to conduct escaping gas quickly to another burner before an explosive mixture can form in the tunnel.

Wire Mill, Forestville, Conn., Aug. 19, 1957. $1,500

Thirty minutes after employees lit a gas-fired muffle-type wire hardening furnace an explosion occurred that cracked the furnace arch. The explosion is believed to have involved gases from one or more burners that were not burning properly due to an overrich mixture.

The gas supply to the plant had recently been changed from manufactured to natural gas. Inspirator adjustments had been made in an effort to provide the proper fuel-air mixture, but since the burners were sealed in and their flames could not be readily observed the inspirator adjustments had to be made experimentally. Burnoff orifices were provided by means of which the fuel-air ratio to the burners could be checked.

The lightoff procedure that was followed prior to the explosion did not include a check of the fuel-air ratio by the burnoff orifices. Had they been used, they would probably have shown an overrich mixture flowing to several burners. Investigation following the explosion showed overrich flames at several burners, indicating that gas from one or more overrich burners collected in the furnace arch where it mixed with air and ignited explosively at a burner flame.

Glass Insulating Mfg., Berlin, N. J., Aug. 26, 1957. $7,000

A 20-million Btu gas-fired heater for heat transfer liquid was extensively damaged by a natural gas explosion in the heating chamber. A momentary electric utility power outage occurred a short time before the explosion. The outage stopped the main air compressor and, according to signal lights, caused manual-opening electric holding safety shutoffs on gas piping to burners to close. However, subsequent investigation revealed that one of the valves had broken and did not close, allowing gas to escape into the heating chamber. The compressor was restarted and after the prescribed purging period, attempts were made to light the burner. It was at that moment that the explosion occurred.

Potato Chip Factory, North Sacramento, Calif., Sept. 23, 1957. $3,000

Due to a breakdown of the potato peeler, the gas safety shutoff valve to the potato cooker burners was shut off. The six pilots were left burning. About 15 minutes later, when the peeler had been repaired, the safety shutoff valve was reopened and the manual combustion air valve was opened permitting a gas-air mixture to flow to the burners. Apparently one or more of the pilots had gone out during the 15 minute shutdown since a gas explosion occurred in the firebox almost as soon as the gas and air valves were reopened.

If this was the case it would explain the explosion, since unburned gas passing through the burner with the unlit pilot would accumulate in the firebox until ignited explosively by a lighted pilot.

Pilots were not equipped with combustion safeguards.

Glass Works, Toledo, Ohio, Oct. 13, 1957. $5,000

An explosion occurred in a glass annealing oven while the external direct-fired heater was being lit after the week-end shutdown. The operator was following his normal lighting procedure which in part consisted of opening the valve supplying gas to the mixer, starting the mixer-blower, inserting a torch in the mixed gas pipe between the mixer and the individual burner manifold and pushing the individual starter buttons energizing burner solenoid valves.

The operator was not aware that one of the solenoid valves had not closed when the furnace was last shut down. During the approximately five minutes that elapsed between the time he started the mixer-blower and inserted the ignition torch, the gas-air mixture flowed through the stuck open solenoid valve to the combustion chamber and through ducts to the oven. The explosion occurred when the ignition torch was inserted.

Domestic and Commercial Appliances

Fire Station, High Point, N. C., Apr. 1, 1950. $1,200

Failure of the safety shutoff valve to operate on a water heater when the pilot light went out, allowed gas to accumulate in the first floor engine room of the 2-story brick, wood-joisted fire station. The ensuing explosion and fire trapped firemen sleeping on the second floor until ladders were raised to second story windows by firemen from other stations.

Stores and Apartments, Fort Madison, Iowa, Dec. 20, 1950. $217,000

The recently installed gas-fired furnace in the basement of this 3-story brick, wood-joisted building had been running poorly and servicemen were called. When two servicemen opened the door to the furnace room a gas explosion occurred that severely burned them and did considerable structural damage to the building. Fire followed immediately and spread rapidly through unprotected openings in fire walls in the unsprinklered structure. Occupants of first floor mercantile establishments hurriedly fled the fast spreading flames.

Apartment House, Alexandria, Va., March 6, 1952. $4,900

Fire Department

An accumulation of gas from a gas stove in the kitchen of one of four duplex apartments exploded from an unknown ignition source. A 17-year-old girl, the only occupant of the apartment, was severely burned. Although the ensuing fire was quickly extinguished by firemen, the initial blast knocked down partitions, broke windows and cracked plaster throughout the apartment.

Automobile Sales and Service, Bellefontaine, Ohio, Feb. 29, 1952. $72,000

Delayed ignition of a gas-fired unit heater resulted in a gas explosion and ensuing fire that destroyed most of the first story of the 2-story, masonry building. The combustible fibreboard ceiling is reported to have been the major contributing factor in the spread of fire through the first story.

Public School, Rocky River, Ohio, March 14, 1952. $100,000

On hearing the warning signal indicating that the burners in a gas-fired boiler had gone out, an employee, apparently without going through the normal procedures of shutting off the gas supply and purging the combustion chamber, attempted to relight the burners. An explosion followed that wrecked the 1680 sq. ft. brick boiler house.

Dwelling, Seattle, Wash., Jan. 6, 1953; 2 killed

Two small children were killed in an explosion of gas that escaped from a defective gas-fired water heater in the second story of the 2-story wooden dwelling.

Dwelling, Pittsburgh, Pa., Nov. 28, 1953, $4,800; 4 killed

A gas explosion at 1:20 A.M. killed four of a family asleep in their 1-story wooden home. The explosion apparently originated at a gas-fired furnace in the rear of the building but destruction was so complete it was impossible to determine the source of the leaking gas.

Public School, Euclid, Ohio, May 18, 1955

The low pressure gas-fired boiler had been shut off at night but was started in the morning by going through the usual procedures of purging the boiler and lighting the burners with a gas wand after turning on the gas with a double safety control. The

boiler had been operating about 20 minutes when an explosion in the boiler blew out the windows of the boiler room, raised the concrete slab roof and severely damaged the boiler.

One of the safety controls on the boiler was a solenoid valve that shut off the gas and sounded an alarm if the pressure dropped below 4 ounces, a value below which the flame would go out. It is presumed that the pressure did drop too low but that the solenoid valve failed to close and sound the alarm. Gas apparently escaped into the boiler and was ignited by the hot interior of the boiler.

Motel, Houston, Texas, June 26, 1955, $2,500; 1 killed

When one of three girls occupying a motel unit lit a cigarette, an explosion demolished the interior of the unit, killing one of the girls and injuring the other two. Investigation after the explosion revealed leaks at the regulator valve for a gas-fired recessed wall heater and several other leaks in the supply piping set in the concrete slab floor. It was also determined that the vent did not extend above the flat roof of the building and therefore would not properly vent unburned gases that would probably escape through the draft hood of the wall heater.

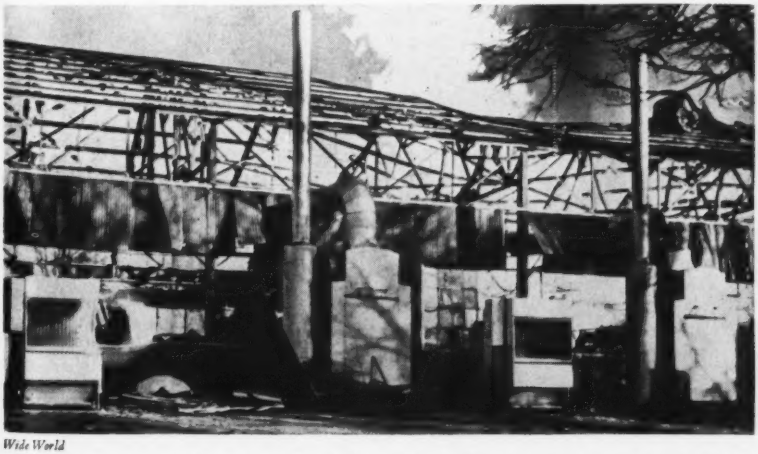
Restaurant, Billings, Mont., May 7, 1957. $60,000

The explosion that blew out the front of this 1-story building and caused fire that completed the destruction of the structure resulted from a mistake in turning on the oven instead of a top burner of a gas stove in the restaurant kitchen. Before closing at 1:00 A.M., the restaurant operator customarily turned on the pilot-lighted burner beneath a soup kettle on the stove so that soup stock would be ready for use in the morning. On the night of the explosion he turned on the gas to the oven by mistake and went home. Since the oven had no pilot, unburned gas escaped from the oven and exploded at 4:40 A.M.

Compressor Stations

Pump House at Gas Plant, Manchester, Mich., March 20, 1950. $50,000

Fire starting from an explosion of gas that accumulated in a 1-story corrugated metal pump house completely destroyed the building. The cause was attributed to gas leaking into the drainage system and entering the building through a manhole, where it was ignited by sparks from an electric motor.



Wide World

Three men were killed by an explosion at a pipeline compressor station at Liberal, Kansas, Jan. 16, 1957. A valve failure allowed natural gas at 900 pounds pressure to escape into the compressor room.

Pumping Station, Granger, Wyo., March 11, 1952. $200,000

An explosion occurred at a 1-story 40 ft. by 112 ft. by 12 ft. corrugated asbestos-on-steel frame refinery pumping station which destroyed the building. A leaking victaulic coupling and lack of automatic shutoff valves on natural gas lines to pumping engines allowed gas to accumulate in the engine room where the explosion occurred. Fire fighting operations were curtailed due to limited equipment available.

Gas Separation Plant, Avenal, Calif., April 4, 1953. $30,000

Rupture of a 12-in. pipe carrying gas under 420 psi released gas that spread over a wide area before exploding. A boiler was the probable ignition source. The office and laboratory building were ignited and escaping gas burned out of control until valves were closed. Absence of panic among trained personnel, who stayed on the job closing valves and manning hose streams, reassured firemen and gave them confidence to approach and fight the fire.

Compressor Station, Charlottesville, Va., June 30, 1956. $20,000

An explosion occurred in a 1-story 60 ft. by 50 ft. brick pump house when gas leaked into the building from a loose expansion joint in a 6-in. line. The pilot light on a gas-fired water heater in the building was the source of ignition. The affected gas line was shut off immediately, and the fire was brought under control in a few minutes.

Compressor Station, Liberal, Kan., Jan. 16, 1957. $885,000; 3 killed

Three men were killed and twelve injured by an explosion at a natural gas pipeline compressor station. A valve failure in the compressor room allowed natural gas at 900 lbs. pressure to escape and ignite from an unknown source. The 1-story 68 ft. by 364 ft. corrugated sheet metal building was severely damaged. Fire burned for two hours until the gas could be shut off.

Utility Gas Plants

Gas Holder, Maryville, Mo., April 28, 1951

Internal corrosion caused the rupture of an aboveground horizontal storage tank

Associated Press

containing 80,000 cubic feet of natural gas. A severe explosion of escaping gas damaged and set fire to a 3-story brick, wood-joisted girls' dormitory 100 yards away. Fifty girls were injured, three seriously, in the blast. Store windows eight blocks from the tank were shattered.

Manufactured Gas Generator Building, Laconia, N. H., March 4, 1952. $68,000

Two employees were injured and the water gas generating building was destroyed by a gas explosion. The source of the escaping gas could not be determined but may have been due to failure of an employee to open a valve, thereby allowing gas pressure to increase sufficiently to force the gas through a water seal.

Gas Works, Battle Creek, Mich., April 26, 1956. $32,000

Rupture of a neoprene static control connection in a 10-in. pipe in the basement released natural gas at 100 psi that exploded on being ignited by the pilot light on a suspended gas-fired heater in the first story. The 2-story steel-framed building was severely damaged by the explosion and was in flames when firemen arrived.

Hose streams were used to cool the building but no effort was made to extinguish the fire until the leak could be stopped by closing the shutoff valve on the pipe several blocks away. Since closing the valve would deprive the entire city of gas, the gas company officials were reluctant to take the step but were finally convinced that there was no other recourse if the fire was to be extinguished.

LP-Gas Storage, Fredericksburg, Va., April 10, 1957. $3,000

Failure to provide for expansion and contraction of liquid-carrying pipe between two aboveground 30,000 gallon LP-gas tanks resulted in a nipple failure beneath one of the tanks. Leaking gas spread into the gas plant six feet away (minimum distance permitted by NFPA Standard No. 59, 50 feet) where it exploded on reaching an open flame. The ensuing fire burned off part of the wood roof of the gas plant. Gas burned at the leaking nipple until the leak became severe enough to cause the excess flow valve to function, after which the fire at the tank went out. During the fire hose streams were used efficiently to cool both tanks.

Unexplained Explosions

College Administration Building, Bluefield, W. Va., March 6, 1951. $75,000

During the two weeks prior to the explosion in this 3-story fire-resistive building, the gas in Bluefield had been changed over from propane-air (5 psi) to natural gas (48 psi). During the evening preceding the explosion there had been a noticeable odor of gas in the college administration building and several students had become ill.

At 7:37 the following morning, when the janitor entered the building and operated the switch controlling the fresh air ventilating system, an explosion occurred in the basement in the vicinity of the gas-fired furnaces. Two of the people in the building were seriously injured as the explosion blew out parts of basement and first story walls, broke most of the windows in the building and cracked interior and exterior walls.

Dwelling, Huntsville, Ala., Nov. 16, 1957 $50,000; 3 killed

Three of the four occupants of this wood-framed ranch-type 1-story dwelling were killed and the fourth was seriously injured when an explosion demolished the building. The ruins indicated that the explosion had occurred in the crawl space beneath the building. Although no gas was piped to the building, the explosion may have involved natural gas. A break was found in a 2¼-in. natural gas distribution main in a nearby street.

Hamilton Spectator, Ltd.

On reporting for work on Sept. 17, 1952 at this Hamilton, Ont. building employees smelled gas. One of them went to the basement to find the leak and was killed a few minutes later by a gas explosion.

An unexplained gas explosion in this Batavia, N. Y. diner killed one person and injured eight on Jan. 12, 1956.

Fruit and Vegetable Warehouse, Hamilton, Ont., Sept. 17, 1952. $200,000; 1 killed

Shortly before 7:00 A.M. a group of employees waiting outside for the day's work to start detected the odor of gas. Several went inside to investigate. A few minutes later a gas explosion occurred that killed an employee investigating in the basement and injured three others.

Bakery, Hugo, Okla., June 21, 1953. $250,000; 1 killed

One of the two occupants of the bakery was killed and the other was seriously injured in a gas explosion and ensuing fire that destroyed the 8,800 sq. ft. 2-story bakery building. Cause of the explosion that occurred at 3:10 A.M. was undetermined. Flames spread to two exposed buildings through plain glass windows.

Tavern and Cigar Store, Hartford City, Ind., July 28, 1954. $175,000; 2 killed

Two occupants of the first story tavern were trapped by debris and killed when a gas explosion in the tavern blew down an interior bearing wall, thereby causing the second story to fall.

On three different occasions during the morning preceding the explosion occupants of the tavern indicated that they smelled gas, but in each instance the owner checked his various gas appliances and found them to be in order. He did not notify the gas company until 12:05 P.M., four minutes before the explosion occurred.

High School, Allen, Okla., Nov. 8, 1954. $100,000

Shortly after the 150 students had settled down for afternoon classes, a gas explosion

occurred that severely damaged part of the 1-story brick, wood-joisted building, and injured 47 students and teachers. Occupants had complained of the odor of gas. The explosion occurred when the school superintendent lit a match to find the leak.

Stores and Apartments, Youngstown, Ohio, Jan. 28, 1955. $28,000

Seven occupants of the 2-story brick, wood-joisted building were injured by a gas explosion in a second story apartment. The explosion occurred when an occupant of the apartment struck a match in the bathroom.

Diner, Batavia, N. Y., Jan. 12, 1956. $54,000; 1 killed

One person was killed and eight were injured by a natural gas explosion that occurred in the basement of the 1-story wood-framed, metalclad diner.

Dwelling and Apartment House, Memphis, Tenn., Dec. 15, 1954

The mother of the family occupying the 1-story wooden dwelling called her 7-year-old daughter to turn off the gas under a pot of beans cooking on the kitchen gas range. At approximately that moment a gas explosion occurred which demolished the house.

A short time later while gas company employees were at the scene trying to locate the source of the leaking gas another explosion occurred in an adjacent 2-story brick, wood-joisted apartment building.

Apartment House, New York, N. Y., Jan. 24, 1957

When the occupant of a second story apartment lighted a cigarette in the kitchen a gas explosion occurred that wrecked the apartment and blew out windows of the 5-story brick, wood-joisted building.

GAS FIRES

Piping

Building Piping

Paint Store, Lancaster, Ohio, Feb. 4, 1950. $23,000

Nine tons of paint delivered the previous evening caused the first floor to sag and snap a 1-in. gas pipe in the basement. Escaping gas ignited at the pilot of the gas-fired furnace and fire burned undetected in the unsprinklered basement of the 3-story building until noticed by a motorist at 7:15 A.M. An open stairway and the damaged flooring were the means of spread to the first floor sales area.

Lodge Hall, Emporia, Kan., Feb. 14, 1950. $570,000

Ignition of gas leaking from a broken 4-in. main in the vicinity of a gas-fired furnace in the basement was believed responsible for fire that destroyed the unsprinklered 3-story brick, wood-joisted building. Ventilation shafts facilitated vertical spread. Several explosions occurred during the first half hour as gas continued to escape until the street was dug up, the main cut and plugged. No shutoff was provided outside the building. Among records destroyed were aerial maps and farm surveys, representing an estimated 40 man-years of work in preparation.

Trailer Mfg., Crystal, Mich., July 10, 1950. $50,000

When the overloaded attic floor collapsed in this 1-story masonry building, it severed the 1-in. natural gas pipe and electric wires, causing the escaping gas to be ignited. A 250-lb. acetylene tank exploded, blowing out the front of the building, and the fusible plug on the oxygen tank melted, allowing released oxygen to intensify the fire. Because of heavy smoke and heat from burning tires firemen were unaware of the natural gas leak until the extent of the fire made the shutoff valve inaccessible.

Jet Engine Blade Mfg., Battle Creek, Mich., Oct. 27, 1950. $600,000

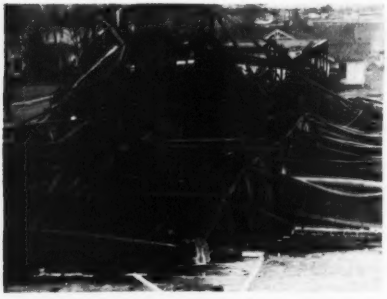
Rupture of a rolling machine hydraulic line carrying flammable hydraulic fluid at 1,100 lbs. pressure allowed the liquid to spray over hot stock and a furnace, where it ignited. When a gas connection to the furnace burned off, flames quickly involved the unprotected steel-framed combustible roof. Although the roof of the rolling room had

Acme

Gas escaping from a broken 4-inch pipe in the basement was believed responsible for the fire that destroyed this Emporia, Kan. building on Feb. 14, 1950. Several gas explosions occurred during the early part of the fire until the street was dug up and the gas main was cut and plugged. No shutoff was provided outside the building.

collapsed before public apparatus arrived, the combined efforts o the private and public fire departments confined damage to 30,000 sq. ft. of the 45,000 sq. ft., unsprinklered 1-story section. Operation of 160 sprinklers in the adjoining 2-story section and prompt closing of all automatic fire doors in communicating openings prevented spread to the 2-story section.

Coil Spring Mfg., Hickory, N. C., Feb. 14, 1951. $400,000



Fire originating at a spring coiling machine on the first floor spread rapidly across the ceiling (saturated with enamel spilled from dip tanks on the second floor) and extended to upper stories of the unsprinklered 14,500 sq. ft. 3-story brick, steel-framed building through open stair and elevator shafts. Enamel in dip tanks and on the floor in the second story, and gas escaping from a ruptured 2-in. pipe (no outdoor shutoff) to an oven intensified fire.

Ceramic Works, Kenora, W. Va., Oct. 29, 1952. $1,400,000

A combination of delays and incorrect emergency procedures resulted in the destruction of two adjacent sprinklered 1-story brick, wood-joisted buildings having a total area of 140,000 sq. ft. The fire originated at 5:30 A.M. and was caused by ignition of gas escaping from a poorly made connection in a 4-in. overhead gas pipe. Records indicating that the leak had started 1½ hours earlier were substantiated by the fact that employees had noted gas odor but had made no serious effort to locate the leak.

Free Press Standard

On July 30, 1955 fire destroyed this fire brick plant at Carrollton, Ohio. The fire originated in the kiln room and was confined to that area until a 4-inch gas pipe broke in the kiln room. Firemen went to shut off the gas at the control house but discovered that the hand wheels had been removed from the control valves.

Following flash ignition, an attempt was made to telephone the alarm, but by mistake the wrong department was called and it was 6:00 A.M. before apparatus arrived. Refusal of firemen to discharge water in the vicinity of 440 volt wires resulted in a further delay of 38 minutes before public hose streams were placed in operation. In the meantime sprinklers opened but because of the many heads operating and the one hour delay in starting the fire pump, water discharge was inadequate to prevent involvement of the roof. The pumper connection to the sprinkler system was not used. Gas from the broken pipe continued to discharge into the fire area until the main supply valve was closed at 7:00 A.M. At 7:18 A.M. the electric fire pump stopped because electric power to the plant was cut off.

Shopping Centre, Boardman, Ohio, Dec. 2, 1953. $187,500

Absence of automatic protection, and lack of fire walls between tenants were the principal reasons for destruction of three stores in the 1-story brick, steel-framed building. However, a broken gas pipe also hampered firemen in their efforts to keep fire from the rest of the 24 stores in the building. A ceiling gas heater fell soon after apparatus arrived. Because gas meters in the utility room were not labeled, as requested by the fire chief, fire fighting was delayed several minutes until firemen had shut off every meter to be sure that the valve supplying the broken pipe was closed.

Stores and Apartments, Parkersburg, W. Va., Aug. 27, 1954. $256,000

Fortunate discovery of the fire by police at 1:20 A.M., before it had spread out of the basement, allowed all occupants of the second story apartments to escape safely. Soon after the alarm was given, flames extended up open stairways to upper stories of the L-shaped, 10,000 sq. ft. unsprinklered 3-story brick, wood-joisted building. During the fire, a 2-in. gas pipe in the basement ruptured, releasing gas that burned for an hour until the street was dug up and the corroded valve in the curb box shut off with a pipe wrench.

Hotel and Stores, Memphis, Tenn., Oct. 23, 1954. $250,000

At 1:19 A.M., the hotel clerk on one of his half-hourly tours of the hotel corridors (the hotel occupied the second and third stories of the 3-story brick, wood-joisted building) noticed smoke coming from the basement stairway. Guests, notified by a room buzzer system, escaped in their night clothes.

On arrival, firemen found much of the basement involved in fire, and as is usual with fires in unsprinklered basements, were delayed in getting water on the fire because of the smoky conditions and limited access.

During the fire, gas escaped from a pipe in the basement and exploded, in some instances violently. Repeated efforts by gas company employees and firemen to get into the basement to shut off the gas valves were thwarted by heat and explosions. The valve was finally located outside the rear of the building.

Magnesium Refining, Freeport, Texas, Dec. 4, 1954. $400,000

Failure of a coupling on a 4-in. gas line to a gas-fired burner under a decomposition cell was followed by an intense gas fire on the first floor level of the 2- and 3-story mostly noncombustible building. The operator on an upper level immediately left the building to shut off the gas supply to the building, but when he could not close this valve, he had to close another valve supplying gas to several buildings. Before the fire brigade and public fire department could put hose streams in operation, fire had spread to part of the wood roof deck and monitor. Draft curtains were credited with limiting lateral spread of fire beneath the roof deck.

Motel, Houston, Texas, May 17, 1955. $7,600

While a workman, who was remodeling the motel, was moving a stove from one of the units he accidentally broke a gas pipe. Following ignition of escaping gas at a water heater, fire spread throughout the six units.

Fire Brick Mfg., Carrollton, Ohio, July 30, 1955. $250,000

During the night the high piled load in the 70-ft.-diameter kiln (originally constructed for firing lightweight pottery) caused the kiln to sag. The load shifted causing the dome to break and release heat (2300°F. temperature in the kiln) which ignited roof timbers directly overhead. The two employees present attacked the fire with hand extinguishers but the fire spread rapidly out of control beneath the wood roof.

Firemen confined the fire to the kiln room for 30 minutes. Then a 4-in. gas pipe broke which released large volumes of gas into the kiln room. Fire fighters were forced out and the fire then spread through an unprotected opening in a firewall to the adjoining drying room. Firemen tried to shut off the gas at the control house only to learn that the gas company had removed the hand wheels from the shutoff valves. Gas company employees were summoned at once, but it was an hour before the gas was shut off. During this time escaping gas interfered with effective fire fighting. Firemen, did, however, manage to confine the fire to the kiln and drying rooms until part of a hollow tile parapeted fire wall collapsed and allowed fire to spread into the adjoining storage area.

Hydrogen Chloride Mfg., Baton Rouge, La., Nov. 18, 1955. $4,000

While pipe fitters were hoisting material in the high 1-story building a slip occurred which permitted the material to hit and crack a cast iron elbow in a 4-in. natural gas pipe beneath a gas-fired industrial furnace. Escaping gas ignited at an electric fan and continued to burn until the gas was shut off.

Distribution Piping

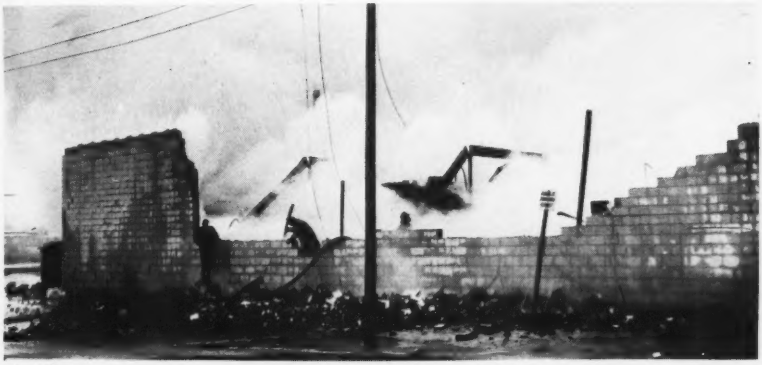
Dwellings and Apartment House, Louisville, Ky., Nov. 10, 1951

About 50 fires, only three of which were of a serious nature, broke out in dwellings and apartments when a gas pressure regulator on a distribution main failed. As soon as the fire department learned what had happened (about 30 alarms were received) most of the engine companies in the city were dispatched to the district where they cruised the streets putting out fires as they were reported.

Investigation revealed that a stone in the main had lodged in the upper seat of the pressure regulator, preventing the regulator from operating, and permitting high pressure gas to enter the low pressure system. Despite the operation of six relief valves at other regulator stations in the system, excess pressure existed for about 20 minutes until the condition was relieved, indicating a need for more adequate overpressure protection.

Gas Distribution Pipe, Detroit, Mich., Sept. 7, 1955

During a pressure test to certify the natural gas pipe for use at 150 pounds pressure a section of pipe pulled out of a Dresser coupling. Escaping gas opened a small hole in the pavement and ignited about 10 minutes later. At the time of the test men at control valves were in radio communication with men at the site of the break. Conse-



Alpena News

This fire in a supermarket was one of two that broke out in Alpena, Mich., on March 5, 1957 after failure of gas public utility equipment allowed too high a proportion of propane to enter the propane-air distribution system.

quently the valves were closed and the fire brought under control minutes after ignition.

The pressure test was being conducted according to the recommended method and the coupling, which was about 40 feet from a 90 degree bend was anchored in place in an approved manner by a mass of concrete.

Gas Distribution Pipe, near Sandusky, Ohio, April 1, 1956

A power shovel being used to lay a sewer knocked the cap off a 12-in. high pressure gas distribution pipe in the street. Escaping gas ignited at a warning flare that had been placed at the edge of the excavation. Flames destroyed a contractor's truck and scorched two dwellings. Fire fighters tried unsuccessfully to put out the blaze with dry chemical and the fire raged for three hours until a valve upstream had been closed and most of the gas downstream had been consumed.

Appliances

Domestic and Commercial

Stores and Offices, Ottawa, Ont., Nov. 25, 1950. $100,000

The first and second stories of the 8-story brick, wood-joisted building were badly damaged by fire that originated at an automatic water heater in the rear of a first story drug store. Investigators concluded that delayed ignition of gas by the pilot caused the gas to flare and ignite dust and refuse in the vicinity of the heater.

Supermarket, Liquor Store, Alpena, Mich., March 5, 1957. $116,500

Failure of the electric water circulating pump for a propane vaporizer, due to a power outage, allowed liquid propane to enter the mixing chamber, thereby permitting a much higher percentage of propane to enter the city distribution system than under normal conditions. Gas appliances throughout the city flared up and in at least two instances started fires in buildings.

In a 1-story masonry, wood-joisted supermarket a ceiling-suspended unit heater ignited the combustible fibreboard ceiling and since there was no automatic protection or watchman the fire developed undetected in the undivided 150 ft. by 50 ft. building until discovered by an outsider at 5:15 A.M.

While firemen were working at the supermarket fire they were called to a fire that extensively damaged a 1-story masonry wood-joisted liquor store. This fire also started at the ceiling above a suspended gas-fired unit heater.

Paint Store, North Hollywood, Calif., Apr. 12, 1957

A broken connection on a gas-fired space heater permitted gas to escape and ignite at a pilot light. Due to the absence of automatic fire protection the fire burned for at least an hour before being seen by a passerby, by which time it had totally involved the 2-story wooden building.

Wide World

During a pressure test of a gas distribution pipe in Detroit, Mich., Sept. 7, 1955, a section of pipe pulled out of a Dresser coupling. Escaping gas ignited but the fire was quickly controlled due to the fact that men at the test site were in radio communication with men at control valves.

Industrial

Tobacco Curing Barns, Westfield, Mass., Aug. 4, 1956. $182,000

Five in a row of ten 9,100 sq. ft. fully loaded tobacco curing barns were destroyed by fire that broke out when an employee attempted to light a gas heater in one of the barns. Flames immediately enveloped the corner of the barn where the heater was located and soon had involved the entire structure. A leaky connection at the heater was the determined cause.

The 60 feet of clearance between buildings proved to be inadequate as wind-driven heat and embers ignited the four barns downwind from the barn of origin.

Utility Gas Plants

Gas Compressor and Pump Building, Syracuse, N. Y., Jan. 14, 1957. $50,000

The 1-story compressor and pump building, in which natural gas pressure was increased from 40 pounds to 175 pounds, was practically destroyed by fire that broke out in the control room. Information on the source of the leak and the ignition source was not available. With thousands of cubic feet of gas feeding the flames, the fire continued out of control until a valve was closed about an hour after the outbreak.

Gas Well Drilling Rig, near Indiana, Pa., Mar. 4, 1957. $100,000

During drilling operations in search of a high pressure gas pocket, gas from a low pressure pocket ignited while a bit was being changed. Evidence at the well site indicated that persons had been smoking too near the site. Firemen used low pressure water fog streams to cool the drilling rig and then used dry chemical to extinguish the burning gas. There was no reignition.

Public Gas Utility, Tioga, N. D., Aug. 15, 1957. $6,000

Fire broke out in a 12-in. natural gas pipe approximately 2,000 feet upstream from a meter building and at the point where compressed air was introduced into the pipe to reduce the Btu content of the gas. The fire in the pipe expanded the underground pipe upstream of the meter building, melted the covering and caused damage to the meter building because of pipe movement.

It is believed that oxidation of iron sulfide in the pipe at the point where compressed air was introduced caused the gas to ignite.

Prussian Fire Protection 300 Years Ago

By Reinhold A. Dorwart

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In the seventeenth century, many German territories were surprisingly advanced in fire prevention and protection. Perhaps the most progressive in developing means of combating the hazards and ravages of fire was the Kingdom of Brandenburg-Prussia, particularly the Electorate of Brandenburg. The ruling dynasty of the Hohenzollern in the seventeenth and eighteenth centuries proved themselves singularly concerned with the welfare of their subjects. They exhibited this interest in numerous edicts and regulations designed to protect public health, to advance the economic interests of the people and to safeguard their lives and property through legislative efforts in fire prevention and protection.

One of the earliest legislative efforts in the interest of fire safety appeared in 1660 under Frederick William, The Great Elector (1640–88). In an Edict of 23 May 1660[1] he recognized the vast damage done in towns, villages, forests and meadows because of the careless handling of fires and because of the inadequate supplies of fire-fighting equipment. Thus, at the very beginning, he connected the two major tasks of preventing and fighting fire. At this stage both the prevention measures and the equipment available to fight fires were primitive, consisting of spades, shovels and axes. To prevent fires, the Elector ordered all householders to watch their home fires carefully, not to permit servants to go into barns and lofts with torches, ordered shepherds and other herders to extinguish completely the fires they used in the fields for their comfort, and forbade the burning of grass without authority from the proper persons in towns or villages. Then, as now, human carelessness was underscored as one of the major factors in causing fire.

The following year, by a Patent of 10 December 1661,[2] Frederick William undertook to further the cause of fire protection by more constructive action. Addressing himself to the authorities in the towns and cities of two provinces in the Electorate, the Elector lamented the damage caused by fires during the war years (1655–1660), the severity of which in most instances was caused by lack of fire-fighting equipment. He ordered the city fathers to take up a community collection with which to obtain the necessary equipment. The latter was to include such useful appliances as long ladders, leather buckets, fire axes, water tubs on sledges and large and small squirt guns.[3] He also ordered the removal of all straw and hay roofs within the towns and their replacement with tile.

Ordinance of 1672

A Fire Ordinance of 15 July 1672[4] set the pattern for the next sixty years of legislative effort to protect Berlin and Brandenburg from the hazards and damage of fire. This ordinance consisted of three essential parts. The first dealt with the removal of that which represents a fire hazard and causes damaging fires. The second concerned itself with the appliances and equipment needed for the extinction of fire. And the third part detailed the organization of a city community for fighting fire and the methods to be used.

Fireplaces and Chimneys

Frequent fires were caused by the defective construction of fireplaces and

Tubs of water on sledges drawn by horses supplied water for this early "fire engine."

chimneys and by foul chimneys. Accordingly, the Fire Ordinance of 1672 ordered that fireplaces, hearths, ovens of householders, brewers, bakers, soapboilers, smiths and similar craftsmen must all be separated from wood structures by stone or tile. All fireplaces and chimneys then existing and built partly of wood were ordered destroyed, to be rebuilt of stone and masonry. This was to be accomplished within four months. On pain of losing their masters' status, no masons were to build chimneys so narrow that a man could not pass through them. Walls of chimneys were required to be of adequate thickness. Chimneys were to be swept from top to bottom three times a year. If chimney-sweeps observed any masonry weaknesses, they were to report this fact not only to the houseowner, but also to the city council.

Barns and Sheds

Recognizing them as a source of danger, the Elector ordered that all barns and sheds used to store unthreshed grain and surplus hay were to be removed from within the city walls and built outside the walls. In an age when stables and hay were as common in use and danger as the modern garage with its oil and gasoline, the Elector urged that covered lanterns be used in stables rather than open torches, and that no smoking be permitted by servants around hay.

Woodworking Hazards

Protective measures were aimed at certain craftsmen who by the nature of their work or materials represented a potential fire hazard. Coopers, cabinetmakers, latheturners, wheelwrights, and others who produced wood shavings and chips were ordered to watch their fires and lights carefully and to clean out such chips daily, storing them in a safe place.

Tanneries and Other Hazardous Occupations

Shoemakers were not to keep tanning vats in their shops and were ordered to set up their tanneries outside the city along the Spree River. Similar preventive measures were required of ropemakers, torchmakers, butchers, and

soapboilers. Housewives were forbidden to boil clothes at night and were required to store fats and grease in dirt subcellars.

Brewers in the curing of malt were ordered to coat their kilns inside and out so that fire could not reach firewood stacked nearby and barrels of water were always to be kept ready. Gunpowder was to be stored safely and could not be sold within the cities without license from the city council.

Open Torches

The carrying of pitch and pinewood torches on the streets was discouraged, particularly on windy nights, and the use of lanterns was again ordered. Servants going out alone at night were not to be allowed to carry such open torches.

Enforcement

To enforce these preventive measures the ordinance ordered a semiannual inspection of all liable establishments including all privileged and exempted persons. Properly enforced, it might be expected that the dangers from fire were to some extent reduced by these measures.

Fire Watch and Alarm

Even in those days, it was realized that prevention is only one phase of fire protection and that the community must be prepared also to extinguish fire. The Fire Ordinance of 1672 therefore prescribed procedure for fire watch and alarm, and preparation of equipment and appliances for fighting fire.

Prior to the time when professional fire-fighting brigades stood ready with their equipment to respond to alarms it was necessary to make use of personnel who ordinarily had other occupations. Either volunteer companies could be organized or the whole community could be mobilized with specifically assigned functions, with the task of organizing being undertaken by the state. Under The Great Elector, the latter procedure was followed in his police state. In cities where garrisons were maintained it was customary to utilize the soldiers for fighting fires. The Fire Ordinance of 1672 included the garrison of Berlin-Cöln in its plans. The Military Commandant of the cities was ordered to use the main guard to patrol the streets at night to watch for any sign of fire, to quell it if necessary, and to arouse the watch and neighbors.

The Elector ordered a civic night watch for calling out the hours to be reinstituted. They also were to watch for signs of fire or of unusual smoke, to call out the alarm, and to help put out the fire. Any householder who lost control of a fire in his house or shop was to cry "Fire" and call his neighbors for help.

Watchers, furnished by the guild of musicians, were to be placed in the city towers both day and night. In the event of fire they were to blow their horns. In case of a fire alarm the drums of both the main guard and of the city militia were to be beaten to arouse the soldiers and the citizens. After the alarm was sounded the farthest quarter of the cities was instructed to send its apparatus in part to the scene of the fire and in part to the city hall as a standby reserve.

Fire Fighting Equipment

After making provision for fire watches and fire alarms, the Ordinance next turned to the availability of fire-fighting equipment. Availability meant not only possessing certain types of appliances but also getting them to the scene of the fire. It involved both a public and an individual responsibility.

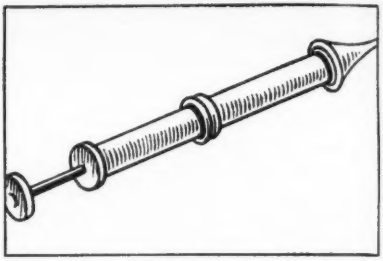
As for specific equipment, all city wells were to be equipped with buckets, and a sledge with a water barrel on it. The streets were to be clear of piles of cordwood, manure, stones and ashes so that the sledge and other drawn equipment could pass. Ladders, firehooks and buckets were to be kept available in adequate supply. Each guard corps of the city garrison was to have a ladder-house to store this equipment for use of

the soldiers. The two city halls likewise were to keep a supply ready, and every householder was to possess at least two leather buckets. Every guild was to furnish ten leather buckets from its guild treasury. Since hand squirt guns had proved useful, according to the ordinance, it was decided to keep a supply of these at the city halls, and each householder was to have one or more. The coopers and tubmakers were all ordered to maintain two water tubs for use with the water pumps.

Manning Fire Equipment

With these preparatory provisions made for location of equipment, the next step was assigning responsibility for its manning and operation. The Ordinance of 1672 exploited the already existent occupational structure of society by making the various guilds, according to their specific skills, responsible for certain functions. As soon as the alarm was raised by the cry of "Fire" or by the sounding of horns, drums or bells, the neighbors were to hurry with their personal leather buckets and hand water guns; the guard officers were to round up all available soldiers and equip them from the corps' supply with ladders, firehooks, and buckets; assigned citizens were to hasten to the city halls to bring up the city-owned ladder wagons and horse-drawn water pumps. Other citizens who owned horses were to report to the city wells to carry or draw water on the sledges to the scene of the fire. The large horse-drawn water pumps were to be operated by the braziers, the brewers were to come each with a hand gun, the coopers were to furnish barrels and tubs. Carpenters and masons were to report with axes and hooks prepared to rip down houses to stop the spread of the fire.

To assure sufficient water for the fire pumps all guilds not already assigned were to bring their required ten leather buckets to the town hall and each master was to send one apprentice with a leather bucket to the scene of the fire.



Each householder was required to have one wooden or metal hand syringe, or squirt gun. These were filled from tubs of water brought to the scene of the fire.

Fire-Fighting Procedures

The actual fighting of the fire resulted from directing a flow of water on the fire from the many small — and rather ineffective — hand squirt guns, and from the large fire pumps which were operated manually by the braziers. Water sledges and bucket brigades kept a steady flow of water passing from the wells or streams to the fire to replenish the water in the large pumps or to keep the barrels full for the loading of the hand guns. Ladders and firehooks were used for scaling of houses, to get up on roofs, for tearing down walls.

This Ordinance of 1672 thus brought about a progressive mobilization of a whole community on an orderly basis with the full exploitation of such equipment as the age had developed for the extinction of fire.[5] Meanwhile the tower watchers from the musicians' guild were to continue to be alert for new fires started by windblown embers. The Military Governor was to bar access to idle spectators by placing musketeers at all crossroads. To avoid loss of personal property by stealing, the Governor was to appoint a Guard Lieutenant with twenty men to join a City Militia Lieutenant with five burghers. These would commandeer the nearest vacant lot and require all persons carrying goods to deposit them there for safekeeping.

If fire broke out at night all corner houses were required to place torches

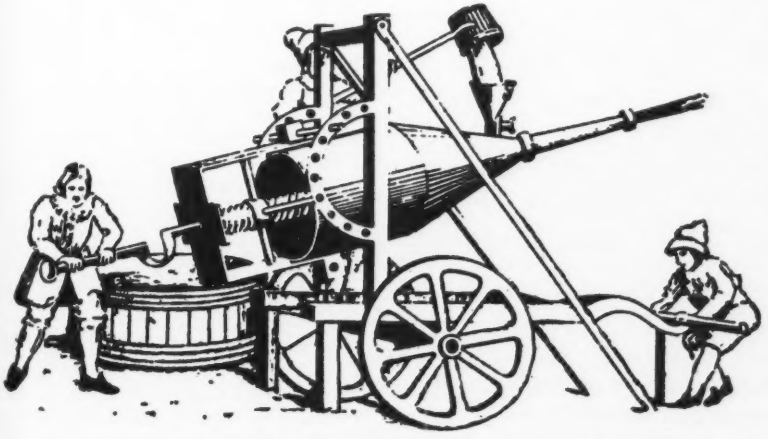
in the streets to furnish light. And in any case all householders were required to fill buckets with water to quench new fires started by flying embers.

The provisions made by the Fire Ordinance of 1672 for fire protection, both in respect to prevention and extinction, were a significant gain in a decade over the facilities and measures employed in 1660, and were probably the most advanced and progressive ideas and organization for fighting fire to be found anywhere in Europe at that time. This organization, established and supervised by the state, with volunteer personnel manning equipment either personally or publicly owned, preceded the establishment of fire insurance companies in Brandenburg.[6]

This Fire Ordinance of 1672 set the basic approach to fire protection for the City of Berlin. Subsequent fire ordinances did little more than modify, expand and improve on the specific measures provided by this Ordinance without altering the basic principles.

Ordinance of 1701

It was not until 1701 that a Fire Ordinance was issued for the rural areas designed to do more for fire protection than the first edict of 1660.[7] It is difficult to conceive any community unit which was more subject to the danger of fire and to the threat of complete annihilation at this time than a European village. Timber construction of cottages with straw or hay roofs, cottages built without chimneys, ovens inadequately constructed within the houses was the usual pattern. The Ordinance of 1701 referred to the fact that frequently whole villages were reduced to ashes, and sometimes were not rebuilt for years; hence certain elements of precaution were ordered for these rural areas. Chimneys were to be built on or in every house or cottage; fodder, hay and straw were not to be kept close to a hearth; ovens for baking were to be built outside the houses; bake ovens were not to be used for drying flax but this should be done in special ovens located a musket shot away from houses; the village smithy and his forge as well as drying kilns for hops were not to be located close to village cottages. Village governments were ordered to equip themselves with ladders, firehooks, buckets and water pumps for extinguishing fires.



Three men were necessary for operating an ancient syringe fire pump.

Ordinance of 1707

The first major revision of the 1672 Ordinance was issued on 3 May 1707.[8] Elimination of fire hazards again concentrated on chimneys, ovens and kilns. An expanded economy had, however, introduced new hazards.

New Prevention Orders

Perhaps the most important gain was the recommendation that a piece of sheet iron be inserted in a chimney so that it could be used to shut off a chimney fire. Not only were chimneys to be swept quarterly but the chimney-sweeps were to keep a register of all chimneys and if owners were negligent about summoning them, they were to remind the owners of the need and to sweep the chimneys. Payment of wages would be enforced by the magistrates.

Wooden raingutters were banned, either tin was to be used or stone drains built to carry off the rain water. The amount of hay, straw, and kindling wood which could be stored within the city walls was severely regulated, both for individual and industrial use. Preventive directives were aimed at the safe storing of empty beer, wine and brandy kegs, and the tanbark of shoemakers. Rules were established for the proper disposal of coal and wood ashes, the safe storage and use of hemp, pitch and wagon grease by torchmakers and the segregation of tanneries.

Since a new cause of fire was introduced from the New World in the seventeenth century, the 1707 Ordinance ordered that no one, native or foreigner, was to smoke tobacco when on hay or straw floors, in stables, in bed or in other dangerous places. Quartered soldiers were ordered to be careful with fire, lights, and smoking. Hosts were required to report carelessness to the Governor or Commandant. Innkeepers were responsible for keeping watch on safe use of lights and fire by guests.

Fire Inspection Instituted

So that the preventive measures ordered in the ordinance would be observed, an annual inspection of all liable places was instituted to report any violations. A clue to public response to the preventive measures is found in the further order that the Governor or Commandant would assign necessary noncommissioned officers to protect the inspectors.[9]

Further Provision for Fire-Fighting Tools

The value of having on hand ready for use a variety of equipment and apparatus was again emphasized in 1707 by requiring all householders, in proportion to the size of the house, to provide themselves with leather buckets. not less than two per household. Each resident was also to have available a metal or at least a wooden squirt gun, and a ladder to get at the laths and rafters. During the summertime every house was required to maintain on the top floor one or two tubs full of water as well as a squirt gun.

Some thirty-seven guilds were made responsible for furnishing the city halls of the two cities and their suburbs[10] with an assigned number of leather buckets. At the city halls there should also be maintained a supply of hand squirt guns, ladders and firehooks ready-loaded on wagons always ready to go. The members of the cooper guild were always to have ready two tubs to take to fires for use of the hand guns.

Fire Pumps

The major weapon on which the success of fire extinction depended (and for which the elaborate preparation of buckets and of a bucket brigade was designed) was a large metal fire pump manned by pumping teams from the braziers guild. The latter were responsible for periodic testing and servicing as well as operation in time of fire. Each city and suburb was to make available a number of these pumps, four for Berlin, three for Cöln, two for Friedichswerder and one for Dorotheenstadt. Ten large fire pumps for a population of probably not more than 60,000 as early as 1707 was a rather remarkable achievement.[11]

The pump shown above was used in Prussia during the Sixteenth Century. Citizens poured water into the wooden tub, while braziers manned the pump.

Fireboats

Even more remarkable was the addition in this year of fireboats on the canals and river running through Berlin.[12] The Hausvogt (Commandant of the Berlin Prison) was ordered to keep ready two flat-bottomed boats with large fire pumps which, with the cooperation of the fishermen and the braziers, could be used for fire-fighting. Since Cöln was on an island between two branches of the Spree River, the river and canals made much of the city accessible to these fireboats. It was a significant innovation and addition to fire-fighting capabilities of the city.

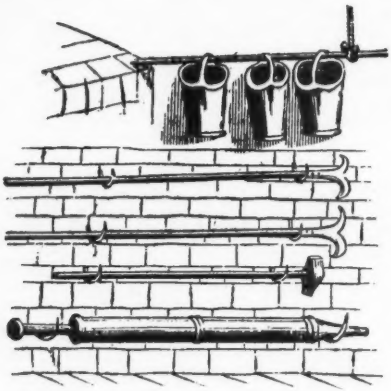
Water Supplies

The inspectors were instructed not only to check all wells in the city, and to see that the associated water sledges and barrels were in good repair, but were to provide alternate facilities for drawing water from the Spree River and the canals if the wells went dry.

Improved Fire-Fighting Organization

Earlier provisions for fire watches and for fire alarms were repeated in the Ordinance of 1707 without change but an improved organization for fighting a fire after the alarm was sounded was established. The burgomeister of the city affected was to report to the city hall and take charge of all operations. The other burgomeisters were to report to the scene of the fire to assist the fire chiefs in keeping order and to check if the guildsmen and others assigned specific fire-fighting tasks reported on time.

We learn of fire chiefs assigned to take charge of the fire fighting, to organize the bucket lines, two lines extending from the water barrels to the fire pumps, and of well inspectors who reported to the city wells to supervise the filling of water barrels. The sledges were pulled by the horses which had first drawn the fire pumps and ladder wagons to the scene of the fire. The market inspector, in case of night fire, was assigned to open up the city hall and to distribute the necessary apparatus. He was not allowed to remain out of the city overnight without the permission of the burgomeister.



Illustrated are 17th Century leather buckets for carrying water, fire hooks for pulling down walls, a sledge hammer, and a hand syringe.

The church bellringers were instructed to report to their churches with water guns to watch for fire brands landing on church roofs. The citizen captain of the quarter most removed from the fire was to bring up forty or more men to help the garrison close the avenues to spectators and to establish an open place under guard for storing salvaged goods.

Post-Fire Precautions and Investigations

Another expansion over the original ordinance of 1672, showing a commendable concern for detail of organization, involved plans for procedures after a fire was extinguished. Certain citizens as well as members of the carpenter and mason guilds were to stay as a fire watch to prevent rekindling of the fire. All the used fire gear was to be accounted for, returned to its place of origin, inspected by the city officials, and any damage reported to the fire chiefs. The braziers were to repair any damage to their pumps. The wells were to be inspected.

And then the city council along with the Hausvogt was to make an investigation of the cause of the fire and if anyone was to blame to prosecute him. This latter emphasis on studying the cause of fires, as well as constant readiness and proper repair of all equipment must be included among the progressive features of fire protection in Brandenburg in the early eighteenth century.

Pay for Fire Fighting

Provision was also made for the payment of certain personnel involved in fighting fires. The first one to raise an alarm was to receive two thaler, the first to bring a fire pump from each city, and the first to bring up a water barrel were each to receive three thaler. The braziers, carpenters, masons, and the soldiers who helped fight the fire were to be paid. Payment would be made from a fund raised from fines resulting from fire neglect and from merchants who did not give labor contributions.

Later Ordinances 1708-1727

In 1708[13] and in 1709[14] the King made an effort to reduce the danger of general conflagrations by ordering the building of firewalls at frequent intervals between residences.

Firewall Ordinance Resisted

It had been noted that fires consumed everything in their paths because there were no obstacles to their spread. It was thought that this might be prevented if firewalls were erected between houses at periodic distances of every four to six houses. Such a firewall was designed to pass completely through a block from street to street and was to be two feet above the height of roofs. Since the cost of this building modification had to be borne by the affected houseowners, it was met with the same general civic resistance with which the orders to build better chimneys and to tile the roofs was met. In the case of the firewalls the king suspended the requirement to build them in 1710.[15] The issuance of repeated edicts concerning replacing straw roofs with tile,[16] of building chimneys safely of brick,[17] safeguarding ovens with double bricked walls, and of the dangers from smoking tobacco[18] also indicate that these basic preventive measures were not completely complied with by the citizens of towns and villages.

Enforcement Tightened

Somewhat in desperate exasperation, the new king, Frederick William I (1713–1740), in 1723[19] complained that there had been no lack of fire prevention regulations but too much failure to observe them so that serious fires still occurred. He ordered all his enforcement officials from the territorial regencies to the village bailiffs to enforce these regulations on fire prevention as well as the inspection of fire-fighting equipment.

It is rather surprising to find that after the significant progress made between 1672 and 1707 in respect to fire protection there was practically no progress made in the next thirty years.

Frederick William I, as a King, was distinguished for his administrative genius and the reforms he accomplished in the administrative organization of the state. In 1718 he was more successful than his predecessor in starting permanent fire insurance companies.

Territories Expanded and Organized

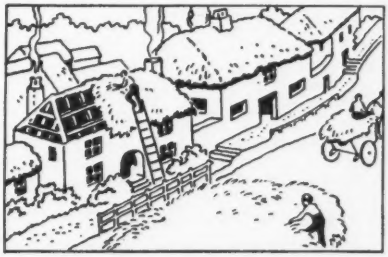
The General Fire Ordinance of 1 November 1718[20] showed little originality. It did extend to all the cities of the whole territory of Brandenburg the same general provisions for fire prevention and fire fighting which had been ordered for Berlin and its associated cities and suburbs by the ordinance of 1707. Extending the experience acquired in the capitol to the territorial cities might be considered a gain in protection if not in technique.

Fire Fighting — 1727 Style

The metropolitan city was divided into nineteen zones with each zone having two Zone Wardens to take charge of all fire fighting, salvage and rescue work in their zones. Zone wardens were augmented by fire and water commissioners. The latter were responsible for assuring the steady flow of water from the wells and river to the pumps and barrels. The fire commissioners turned to supervision of fire fighting on the scene. The captains of pumping crews, attached to each fire pump, were called fire chiefs.

By the Fire Ordinance of 1727,[21] it was established that after an alarm was sounded the immediate neighbors within twenty to twenty-five houses of the fire on all sides hurried to the affected house or building with their personal buckets, ladders and hand guns. They were the first wave of firefighters. Only the three adjacent neighbors were excused to protect their own homes. Meanwhile, the market inspector, if the fire were at night, was opening up the city hall and passing out buckets and black frocks (established as a uniform) to the apprentices who were rushing up; assigned dray horses and teamsters reported to the city hall ready to draw the ladder wagons and large fire pumps to the fire.

The water inspectors hurried to the nearby wells or other water sources and supervised the filling of the water sledges or water buckets. The fire chiefs rolled up their fire pumps as close to the fire as they could so that the leather or canvas hoses might reach the fire, and while the braziers manually operated the piston pumps the citizen bucket lines poured a constant stream of water into the tanks with buckets flashing up one line and being passed empty down another. The coopers' tubs were also kept full. Soldiers and citizens filled their thirsty squirt guns in these and



It took repeated edicts to secure enforcement of a ban against straw roofs, commonly found in early European villages, in favor of fire-resistant tile roofing. Similar trouble was later experienced in the United States with wood shingles.

somewhat ineffectively sprayed their small streams on the fire. The hand guns were useful to those who climbed ladders up to the roof or rafters to get at the fire where the big pumps could not reach. The masons and carpenters stood ready with firehooks to tear down either the burning building or adjacent buildings to check the spread of the fire. On the scene of the fire it was the several fire commissioners who organized the bucket lines, and on the several sides of a house directed the fire fighting or the salvage and rescue work.

Meanwhile both military guards and men of the city militia were ordered to block off the streets and to hold back idle spectators, to keep the streets clear for the passing water sledges, and to protect an open area where salvaged goods could be stored in safety. Bell-ringers reported to their churches to take station on roofs and towers to watch for fire from flying embers which they would seek to douse with their hand guns. No able-bodied persons other than royal officials were exempt from fire fighting in some capacity; everyone in the community had specific assignments. Not all went to the scene of the fire. A standby reserve was retained at city hall by the Zone Warden, composed in part of persons from other zones. In case of a second fire no one was to leave the first fire unless so directed by proper authority.

In the event the fire occurred along the riverfront or in a building accessible from one of the canals, the fireboats were floated in by the fishermen and river boatmen while the braziers again manned the pumps to pour a stream of water on these buildings. In the first half of the century these pumps poured water out at an approximate rate of 50 to 100 gallons per minute.

When the fire was extinguished, certain militiamen, masons and carpenters stayed on the scene to watch for any rekindling. All equipment had to be returned to the place of origin: buckets, hand guns, ladders, firehooks, water tubs and sledges, wagons, and fire pumps. Wells and fire pumps were inspected immediately for any necessary repairs.[22]

And when the smoke and bustle had died down the city council ordered an investigation into the origin of the fire to determine if there was any basis for prosecution.

Summary

The fundamentals of fire prevention and fire protection were thus well established in the seventeenth and eighteenth century in Germany. This glimpse into the past places in proper perspective the never-ending character of the war against uncontrolled fire and the importance of attacking the problem in all its varied facets. Public apathy during the Hohenzollern dynasty in Germany is not unlike that existing today and the need for public education is a continuing chore for all segments of NFPA membership.

References

[1] Edict That Fire Should Not Be Handled Carelessly, *Corpus Constitutionum Marchicarum*, Christian Otto Mylius ed., (Berlin, 1740), Vol. V, Part I, Ch. 2, No. 1, Cols. 139–42 — hereafter cited as Mylius.

[2] Patent That Fire Apparatus Be Available and That Straw and Hay Roofs Be Eliminated, Mylius, No. 2, Cols. 141–4.

[3] The most common water-throwing device in the seventeenth century was the syringe or hand-squirt (*Handspritze*). A brass tube usually, though sometimes made of wood, one and one half inches or more in diameter, about two and one half feet long, it held from two to four quarts of water which was expelled by a plunger through a nozzle of one-half inch bore. It was filled from tubs of water placed near the scene of the fire. Cf. Thomas Ewbank, *A Descriptive and Historical Account of Hydraulic and Other Machines for Raising Water*, Fifteenth Edition, (New York, 1864), p. 315.

[4] A Fire Ordinance Approved by The Great Elector for Berlin and Cöln, Mylius, No. 3, Cols. 143–56.

[5] Just when the earliest pump engine for fire-fighting was used is difficult to say, but probably in the early seventeenth century. Suction and

piston pumps were used in the sixteenth century for lifting water and the principle was applied in the seventeenth century to fire extinction. See A. Wolf, *A History of Science Technology, and Philosophy in the 16th and 17th Centuries*, New Edition, (London, 1950), pp. 512–21, 524–36, 541–2. One of the earliest pump engines of modern times was described in Germany at Nuremberg in 1656 as forcing a stream of water one inch in diameter eighty feet high. Forty feet was perhaps the average height reached in the seventeenth century. At first one lever and one piston was used, then followed the use of two pumps, alternating pistons, two levers manually operated with a resultant constant stream of water. The two pumps were placed in a cistern or tank which was moved on sleds or wheels. Piping at first was made of rigid copper which was replaced successively by flexible leather, then canvas hose. The water tank was kept filled by the bucket lines. While there were technical improvements, particularly in the first decades of the eighteenth century, this manually operated water pump remained standard for over a century until the steam engine was added. See Ewbank, pp. 315–338, *passim*.

[6] The first fire insurance company in Brandenburg, which was state operated, existed between 1706 and 1711. The first permanent company was established in 1718.

[7] Fire Ordinance for the Rural Areas in the Mark Brandenburg, 26 January 1701, Mylius, No. 7, Cols. 169–72.

[8] A Revised Fire Ordinance for the Royal Capitol Cities and Suburbs, Mylius, No. 13, Cols. 191–214.

[9] Inspection and enforcement of the fire ordinances was the key to the success of fire protection but both were frequently lacking. In 1686 Frederick William complained that the regular inspection of all places where fires were used in Berlin was not occurring and ordered the city council to resume such inspections, Circular Rescript to the Magistrates Concerning Inspections of City Fire Installations, 3 November 1686, Mylius, No. 5, Cols. 167–8. In an ordinance of 7 April 1691 the burgomeister and city councillors of the capitol cities were given four weeks to get rid of straw and shingle roofs in the city and to see that they were replaced with tile, Mylius, No. 6, Cols. 167–70.

[10] Berlin, Cöln, Friedrichswerder and Dorotheenstadt.

[11] London in 1667 (after the Great Fire) with a population of about 400,000 was required to have twelve engines, and in 1863 with more than 1,000,000 residents had only forty hand engines. Frederick H. Haines, *Chapters of Insurance History* (London, 1926), pp. 44 and 162.

[12] The first floating fire engine in London appeared probably about 1760, the second in 1767. Francis B. Relton, *An Account of the Fire Insurance Companies Associations Institutions Projects Established and Projected in Great Britain and Ireland During the 17th and 18th Centuries* (London, 1893), p. 437.

[13] Edict That Firewalls Should be Raised at Fixed Distances, 3 September 1708, Mylius, No. 18, Cols. 225–8.

[14] Patent on Rearing of Firewalls, 20 August 1709, Mylius, No. 21, Cols. 229–30.

[15] Notification That the Requirement to Build Firewalls Be Suspended, 26 June 1710, Mylius, No. 24, Cols. 235–6.

[16] Patent of 12 August 1720, Mylius, No. 36, Cols. 259–62, and Declaration of 14 December 1731, Mylius, No. 46, Cols. 311–12, which offered a rebate of 23 per cent of the cost for work done in the next four years.

[17] Edict of 14 January 1716, Mylius, No. 27, Cols. 237–40, and Ordinance of 1 July 1731, Mylius, No. 45, Cols. 311–12.

[18] Edict of 28 April 1723, Mylius, No. 37, Cols. 261–2.

[19] Edict on Failure to Observe Adequately All Previous Fire Prevention Ordinances in Town and Country, of 12 June 1723, Mylius, No. 38, Cols. 263–6.

[20] Mylius, No. 28, Cols. 241–6. The first edict concerning fire prevention of the new king had appeared 14 January 1716, Mylius, No. 27, Cols. 237–40. It listed the familiar fire hazards, ordered inspection of all chimneys, required having on hand proper fire-fighting equipment, and having an ample number of wells dug.

[21] Mylius, No. 42, Cols. 267–310. This ordinance was drafted by the Electoral War and Domain Chamber and approved by the king on 2 April 1727.

[22] An edict of 10 November 1728 indicated that Berliners sometimes damaged or stole parts of the fire pumps. City delinquents apparently were not averse to throwing stones and glass into the water barrels to foul up the pumps and tanks. Mylius, No. 43, Cols. 309–10.

Civil Recourse in Fire Losses

By Michael H. Bagot

Civil recourse seems somewhat unrelated to fire prevention. It can be used, however, as a tool for obtaining compliance with fire regulations. A few cases and situations will show that the cost of compliance is far less than the cost of noncompliance.

Analysis of numerous cases of violations of fire prevention regulations shows that the majority of violations can be traced to one of three causes — either carelessness, ignorance, or cost of compliance. You see, time after time, inspection after inspection, accumulation of oily rags, unused paint near heaters, under stairways, in closets — all the result of carelessness. You run into ignorance by people who just do not know what the regulations require and who will attempt, wholeheartedly, to cooperate with you, but each one of these persons must be contacted individually, and each case assessed particularly, all of which consumes a great deal of time — a lot more than we have — and the only answer is better education in fire prevention.

You are familiar with the efforts expended by fire preventionists to combat carelessness and ignorance. It is my thought to touch on these two subjects, and, more particularly, to talk about those persons who balk at complying with the law because of the cost of compliance.

Fire Escapes

On a hot, dry October afternoon, 23-year-old Lorraine Dotson, an assistant saw filer, was working on the third floor of the Louisiana Lumber Company's saw mill at Standard, Louisiana (Ouachita Parish). Shortly before 6:00 o'clock a fire started between the first and second floors in the lower boxed part of the shaft in which the bandsaw was being operated. The mill proper, where the timber was sawed, was on the second floor of this building. The enclosed pulleys, around which the saw was carried, were suspended one between the second and the third floors, and the other between the first and second floors, where the fire began.

There was heavy dark smoke, which arose through the open shaft to the third floor and spread so quickly that the hose and other apparatus could not be effectively used. Dotson was then in the filing room on the third floor and cut off from his only means of escape which was a stairway inside the building. He burned to death.

At this time Act 171 of 1914 provided in Section I that every building in the State of Louisiana having more than two stories, and every building in which persons are usually employed above the second story, shall have one or more fire escapes on the outside of the said building unless there are adequate provisions on the inside. Sections II and III provided for the approval of the Fire Marshal. Section IV provided:

"That the owner or owners of any of the buildings mentioned in the foregoing provisions of this

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* Reprinted by the special permission of the author from the *Journal of Criminal Law, Criminology and Police Science* (Northwestern University School of Law), volume 45, Number 4, 1954. Michael H. Bagot is a member of the Louisiana State Bar and attorney for the Louisiana Department of State Fire Marshal. He is Chairman of the Legislative Committee of the Louisiana State Fireman's Association and a former lecturer at both Tulane and Xavier Universities. Mr. Bagot, who has participated in several arson and fire prevention conferences, presented this paper at the Third Annual Arson and Fire Prevention Conference. Other phases of the legal implications of fire losses not covered herein may be the subject of future QUARTERLY articles.

Act, who shall wilfully fail or refuse to provibe with the provisions of this Act . . . shall de guilty of a misdemeanor and in case of fire occurring in any of the said buildings in the absence of fire escapes, as provided for in this Act, the owner or owners, aforesaid, shall be liable for damages, in case of death or personal injury, as the result of fire or panic in any of the said buildings."

Here we have a situation where the law clearly required adequate means of escape and yet Dotson is dead.

The lumber company said that the law did not require them to erect a fire escape without some notice from the Fire Marshal, or Labor Commissioner—that is, that the law was not self-operative.

The court made short shrift of this argument by stating:

"The duty to erect such fire escapes is mandatory except where such fire escapes are not necessary. We don't understand the Act to say, or to mean that the duty to erect fire escapes only arises or comes into existence after notice by the State Labor Commissioner or the Fire Marshal has been served upon the owner of the building, though it may be that, before the owner may be criminally prosecuted such notice should be served upon him. We are, therefore, clearly of the opinion that the duty to erect fire escapes is imposed upon the owners of such buildings by the law itself . . . the non-performance of that duty then becomes negligence." (144 La. 78)

The court awarded damages in the amount of $15,000, although this case arose almost 40 years ago. You can imagine what the damages would be presently — considering the purchasing power of the dollar now as compared to 40 years ago.

In this case the lumber company was operating a mill in the usual and customary manner, using appliances as were general throughout the trade and exercising ordinary care and prudence in operating the mill, but the court said the proximate cause of Dotson's death was the negligence of the company in not providing him with the means of saving himself. It was immaterial whether Dotson could reach the fire escapes had they been there. The determining factor was that they were not there.

Let's forget for a moment the incalculable value of human life and just consider what it cost the lumber company not to have a fire escape. Anyone who weighs the cost of one fire escape against the amount of liability which may be attached to him for not having a fire escape, should it be required, or such other safety device as may be required, will find the scales heavily balanced in favor of compliance.

Opening of Doors

A regulation which has caused considerable objection to its enforcement is one requiring that doors open in the line of travel in certain occupancies. Let us now turn our attention to the criminal responsibility and liability as well as the civil liability or recourse in this connection.

This is what happened in Los Angeles, California, a few years ago. Three people were burned to death; two others were horribly burned and disfigured for life. In describing their injuries the Supreme Court of California stated that one of these "who was once a pretty girl is now a hideous caricature of her former self. Plastic surgeons have been unable to replace her eyelids and there is a possibility that her eyesight will be permanently impaired. The other girl's hands and arms were so badly burned that they are now useless and she is thus permanently disabled."

The survivors of this tragedy can explain in their own words far better than any cold court language, the result of failure to meet fire regulations.

The fire occurred in a workroom on the second floor of the building. The tenant of the building was engaged in the manufacture of dice from celluloid. Cellulose tetranitrate is blended with camphor to produce celluloid which is a highly flammable material. When cel-

luloid burns it burns rapidly, and as it burns it emits the gases of nitrogen, carbon and hydrogen, and various combinations of these gases, all of which are hot and toxic in that they burn the mucous membrane.

The second floor of the building was divided into two rooms, the "showroom" and the "workroom." Between these two rooms were double doors which opened *into* the workroom rather than *outward* from it. Against one of these doors, on the workroom side, the tenant had placed a heavy table on which was placed a cash register, thus effectively blocking one half of this exit, which on the day of the fire was the only way out of the room.

Provisions of City Ordinance

The City ordinance required that the door open outward, that is, open only in the direction of the exit. The City ordinance also required two separate exits. At the time the tenant leased the premises there were two separate exits, but prior to the fire the second exit had been blocked by the tenant.

Further, the ordinance required a sprinkler system for this type of occupancy; that is, the use being made of the premises.

In addition, the ordinance required a "certificate of occupancy" to be obtained before a building is occupied, and a "change of occupancy certificate" in the event that the use being made of the premises is changed. This provision is so that inspectors may determine if the building complies with all laws regulating the type of use proposed. It is obvious that some uses, such as the manufacture of celluloid dice, present more hazards than other uses and are therefore more strictly regulated. When the use of these particular premises was changed from "stores and offices" to the manufacture of dice from celluloid, no "change of occupancy certificate" was obtained. Indeed, if one had been applied for it is probable that this tragedy would never have occurred.

So we find that several provisions of this City ordinance were violated. A door opened into, instead of out of, a workroom; the second exit was blocked off, there was no sprinkler system which was required when the premises were used for hazardous purposes such as here involved; and no "change of occupancy" certificate had been obtained. Possibly there may have been other violations, but these illustrate the general situation.

Many people would think that these are minor infractions of technicalities. We have all heard time and time again: "What difference does it make which way the door opens?", or, when we find the required exit blocked we are often told: "Nobody ever uses it so we just put that table there," or "We can't afford a sprinkler system, and anyway we've been here twenty years and never had a fire." You have all heard: "Well, what if there's a fire — it's not your loss," or "I've got a lease on this and I don't see that it's any of your business." These arguments, and many more, are repeated many times every day when city officials attempt to obtain compliance with such laws.

But is there a reason for such laws?

What about the "technical" requirement that a door open outward instead of inward? Testimony of persons who were burned at the fire vividly shows the reason for that provision. (Finnegan v. Royal Realty Co. (1950), 35 Cal. 2d 409, at pp. 416–419). Here are excerpts from the actual testimony:

"Q. And was the door leading from the workroom to the showroom and the one we have been talking about, here, open or closed at the time the fire occurred?

A. It was closed, sir.

Q. Whereabouts in these premises did you get these burns to your hands?

A. I got the worst part of my burns right directly at the door . . . He (Reuter) was hollering for me to help him from the flames on him,

and thereafter the girls and all started running in a panic and hollering, and I crawled over to the door. It was all a mass of flames there, and I got — when I got to the door, I felt this pressure of these people up on top of me, and I reached up and grabbed the knob in my hand, and it slid right on down as I pulled it again; but I grabbed around and pulled up again, and reached down, and when I finally got the door open Miss Merchut had her arms around my waist. I tried to throw her arms off me when I felt the dead weight, but could not. I finally got the door open. The first time I tried to open it outward. In the excitement and panic I forgot which way the door would open, but finally I got it open and got out and pulled Miss Merchut after me.

Q. All right. Let me ask you, which way did that door open?

A. It opened toward me. I had to pull it inward to get out.

Q. That is, it swung inward into the workroom?

A. That is correct, sir.

Q. Was it a two-way door? Did it also open out?

A. No, sir.

Q. I assume it goes without saying you were highly excited while you were there at the door?

A. Yes, sir, I was.

Q. And did you recall, when you got there, which way the door did open?

A. No, sir.

Q. You attempted to open it first which way?

A. I tried to push it from me, you know, to get out. . . . There was quite a bit of panic there at the door. I felt these people shove me from every which direction and pull me down. . . . I was concerned in trying to find the little knob there so I could get out myself. I knew — I was aware of Miss Merchut because she kept hollering "I am burning", and she had her hands around my waist, and I tried to tear them loose, and of course when I got out she still had her hands around my waist. . . .

Q. By Mr. Stanbury (counsel for plaintiffs): Were you, yourself, doing anything at the door except trying to get out?

A. No, sir; that is all I was trying to do.

Q. And in attempting to get out, were you using your hands?

A. Yes, sir.

Q. What were you doing with your hands?

A. Part of the time I was using this one to protect my eyes, and the other one groping around for the little small knob.

Q. All right. Did you use your hand when you got hold of the knob?

A. Yes, sir, I pulled it in and got out.

Q. Now, was it hot around the door?

A. Yes, sir, it was all in flames.

Q. Were there flames around you at the time you got there?

A. Yes, sir.

Q. Did you get your hands burned?

A. Yes, sir. I got my hands all burned, and at the time I got out, why, my hands were bleeding, they were all cut, and the flesh was falling off them. My face was swollen, and I could feel a bursting and cracking sensation to my skin.

Q. Was there anything wrong with your hands before the fire?

A. No, sir.

Q. Have you any way of telling us how long you were at that door before you got out?

A. It seemed like an eternity to me when I was there at the door. . . .

This is from the testimony of the girl whose hands and arms were so badly burned that they are now useless.

The other girl, who was once a pretty girl, but, to use the words of the Supreme Court "is now a hideous caricature of her former self," testified in a similar way about the confusion and panic at the door and the struggle first to push it out then finally to open it in.

From this testimony it is obvious that if the door had opened outward, as

required by law, these women would have reached safety sooner.

Testimony also showed that had the second exit been available the victims might have escaped uninjured. We know that a proper sprinkler system possibly would have prevented any substantial damage; certainly it would have minimized the chances of injury or death. And, as has been mentioned, if a "change of occupancy certificate" had been obtained, these corrections would have been made, and the tragedy probably averted entirely. So we see that there is a reason for each of these regulations.

Similarly, other comparable regulations are also based on sound and valid reasons.

But, returning to the question of criminal liability, here was a case in which there was failure to comply with various regulations, the violation of which constitutes a misdemeanor. Bearing in mind the general enforcement policy heretofore mentioned, do you think the tenant got off with only a nominal fine? If you do, you are very wrong! There is also a law in California which provides that the commission of a lawful act, which might produce death, in an unlawful manner, or without due care or circumspection, which results in the unlawful killing of a human being, is manslaughter; and manslaughter is punishable by imprisonment in the State penitentiary for not to exceed ten years.

Here was had a lawful act, the manufacture of dice, done in an unlawful manner because of violation of these ordinances. What happened to the tenant who was manufacturing the dice? He was indicted on three counts of manslaughter — one count for each death — and was convicted on all three counts! Clearly, the criminal liability for violation of fire regulations can be very severe.

Civil liability can likewise be extremely severe. Further, such liability may extend not only to the tenant but also to the landlord. The dice factory fire to which we have referred is a good example of this. In that case the corporation which owned the building was successfully sued by the women who had been burned. In holding the owner liable, the court stated (p. 423):

"Statutes and ordinances prescribing the safety features of buildings impose a duty of compliance upon the property owner. Where such a statute or ordinance fails to designate the person charged with the duty of compliance, the initial responsibility is that of the owner."

In this particular case, one of the women obtained a judgment of $100,000 and the other a judgment of $65,000, plus costs, against the owner of the building. So we see that violation of fire regulations can be very costly to the owner as well as tragic to others.

The fact that the building was leased to another person did not exonerate the owner. The landlord cannot divest himself of this liability regardless of the terms of the lease. Under the law, the obligation of the owner is to the general public. He cannot escape this liability by a lease which makes it the duty of the tenant to comply with all laws. Such a provision in the lease only affects rights and obligations as between the landlord and the tenant. It might give the landlord the right to terminate the lease or even make the tenant liable to the landlord for any losses sustained, but it would not relieve the landlord of his responsibility to comply with laws applicable to him, nor would such a provision relieve the landlord of any liability resulting from a violation of such laws.

Owner's Liability

Another case in which a lawful act caused injury and the owner was held civilly liable was Stewart v. Palmisano, 31, So. (2) 27.

Dominick Palmisano owned property, a part of which was leased to Mrs. Stewart. In an effort to preserve and

improve his property, Mr. Palmisano got a blow torch and started burning off the outside paint to provide a good surface to repaint. Unfortunately, the building caught fire and some of Mrs. Stewart's personal belongings were lost.

Mr. Palmisano's motives were the best and his description of the use of the blow torch was exactly correct, but the court said there was no other explanation for the fire so it must have been caused by the blow torch. The landlord had to make the loss good.

Tenants' Liability to Other Tenants

So far, we have considered the rights of employees and of tenants against the owners. Let us consider the right one tenant has against another.

One of the landmark cases occurred a few years ago (57 Fed. (2) 852). A metallic vent had been installed from the hood over one of the ranges in a restaurant kitchen to a combustible ventilating shaft which passed through floors and ceilings, and through parts of the building occupied by other tenants, as well as through walls and partitions of that portion occupied by the restaurant. This installation was in violation of the City ordinance of Seattle. The vent had been installed by a restaurant operated by a Nevada corporation which was later taken over by a Delaware corporation. Both restaurants were known as Pig 'N' Whistle. The latter corporation operated for about three years before the fire.

As a result of the fire, the equipment of the Scenic Photo Publishing Company was totally destroyed, and the photographer suffered a terrific loss. They sued the restaurant because the fire had started in the ventilating shaft and spread through the building. Actually, later investigation showed the fire had started over in the ventilating hood where grease had been allowed to accumulate, or in the metallic duct, and spread immediately through the highly combustible vent.

The restaurant sought to escape liability, claiming that it accepted the premises as they were at the time they went into possession, and during the three years of its operation it had not been notified by the Fire Marshal that the vent was illegal and violated the Seattle ordinance.

This suit was in the Federal Court, and the Circuit Court of Appeals affirmed a judgment against the restaurant, holding it liable because of its use of the grease duct contrary to the ordinance stating "These are positive, clear and unconditional requirements that imposed a duty upon the appellant (restaurant). It did not require any notice from the Fire Marshal that the grease duct it was constantly using in its kitchen did not meet the requirements of Section 550. Appellant being charged with knowledge of the ordinance, the only purpose or function that the notice from the Fire Marshal could perform would be to acquaint appellant, who was using the grease duct, that it was not in conformity to the requirements of Section 550."

In this instance a very substantial judgment was rendered against the restaurant in favor of the co-tenant.

Responsibility to Neighbors

Some years ago, when the Ardis Office Building was being erected in the City of Shreveport, a frame house next door to the construction site caught fire, and the owner sued the contractors who were erecting the building, to reimburse him for his loss. The owner alleged that a hoisting engine being used by the contractors did not have a spark arrestor as required by the City ordinance, and, as a consequence, hot coals and sparks fell on the shingled roof of the house and started a fire.

The court found that the contractors knew that the house was old and could be easily ignited, yet they continued to operate the engine very near the house,

although the smokestack was as high as the roof. Of course, they had to make good the loss. All for lack of a spark arrestor. (Prescott v. Central Contracting Co. 162 LA 885).

This is a pretty stiff penalty to pay for such a minor violation, but the law says that if there is a violation of a statute and such violation is the proximate cause of a loss, then the violator must pay for the damages (Taylor v. Texas and N.O.R. Co. 22 SO 2d 771).

Several years ago, in the City of New Orleans, boilers were not required to be inspected, and a cleaning and pressing shop on the corner of Dauphine and Ursuline Avenue had an old boiler which exploded. At the time of the explosion, a three-year-old child was walking on the sidewalk and a heavy board fence, around the establishment, was knocked down by the explosion and fell on the child, crushing him to death.

The court held that the operator of the cleaning and pressing establishment was liable civilly for the loss of the child's life, saying that the owner knew his boiler was old and in a weakened condition and that he continued to operate it at his own risk. (Drago v. Dorsey, 126 SO 724).

Conclusions

We have touched briefly on several high spots to give you an idea that when you are selling fire prevention and safety you are selling money in a man's pockets.

The cost of compliance is always less than the cost of restitution, and carelessness and ignorance are far more costly than careful, good housekeeping. When these few facts are brought to the people and they realize that you are not talking about technicalities and intangible details, but are trying to help them and save them money, you will find their cooperation much better.

Index to Advertisers — January 1958

	Page
American District Telegraph Company (ADT)	A1
Ansul Chemical Company	A23
"Automatic" Sprinkler Corporation of America	A34
Blaw-Knox Company, Sprinkler Division	A14
Cardox Corporation	*Inside Front Cover*
Central Station Electrical Protection Association	A12
Central Station Signals, Inc.	A29
Chicago Bridge & Iron Company	A2
Detex Watchclock Corporation	A5
Gamewell Company	*Inside Back Cover*, A11
Grinnell Company, Inc.	*Back Cover*
Gustin-Bacon Manufacturing Company	A27
Walter Kidde & Company, Inc.	A8, A17
Kinnear Manufacturing Company	A4
Kuhns Brothers Company	A31
Lexsuco, Incorporated	A20
M & H Valve & Fittings Company	A32
R. C. Mahon Company	A18
Charles E. Manning Company	A7
National Fire Protection Association	A22
National Foam System, Inc.	A21
Notifier Corporation	A33
Pyrotronics, Division of Baker Industries, Inc.	A19
Raisler Corporation, Raisler Sprinkler Division	A6
Reeve Electrical Company, Inc.	A24
Reliable Automatic Sprinkler Company	A30
Rockwood Sprinkler Company	A3
Shand and Jurs Company	A13
Sorg Paper Company	A9
Star Sprinkler Corporation	A26
Tokheim Corporation, General Products Division	A10
Vapor Recovery Systems Company	A28
Victaulic Company of America	A15
Viking Corporation	A16
William Wallace Company, Metalbestos Division	A25

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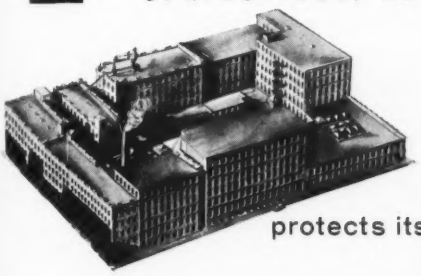

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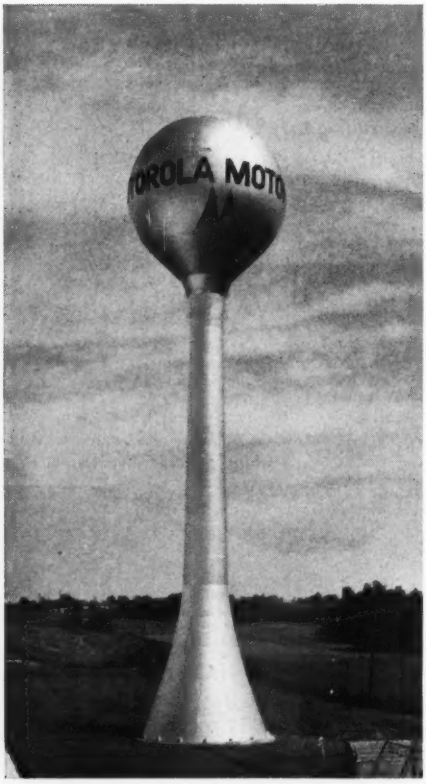

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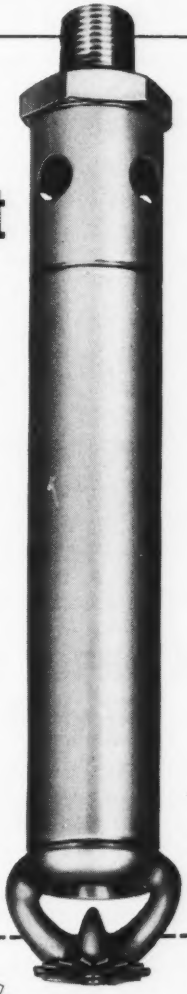

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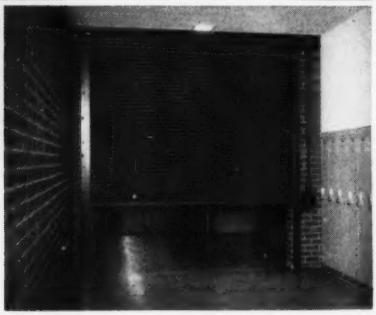

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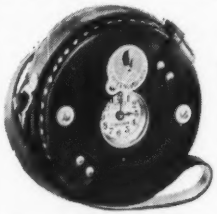

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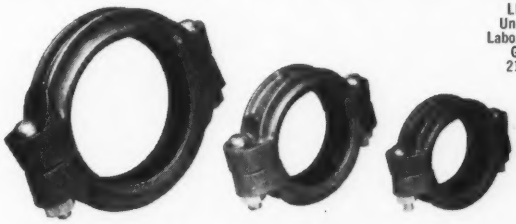

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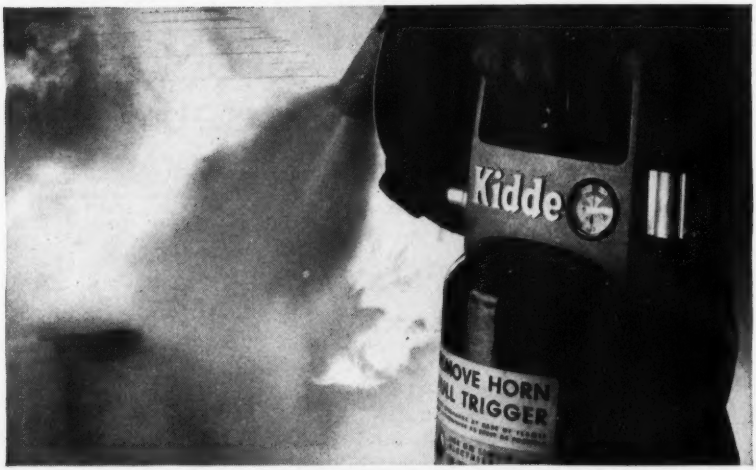

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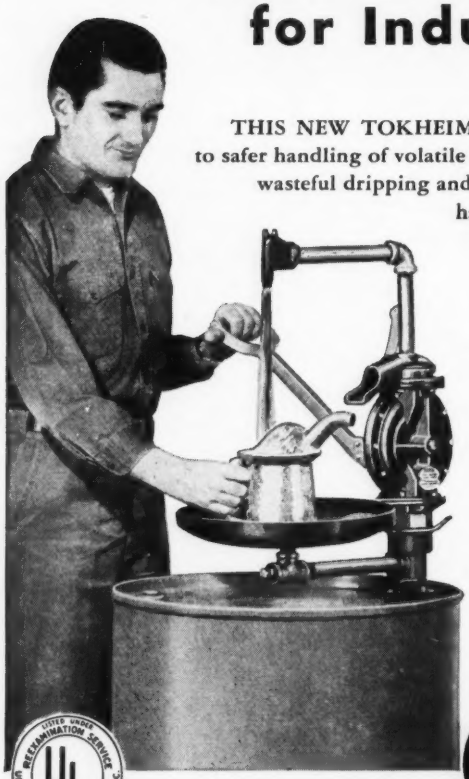

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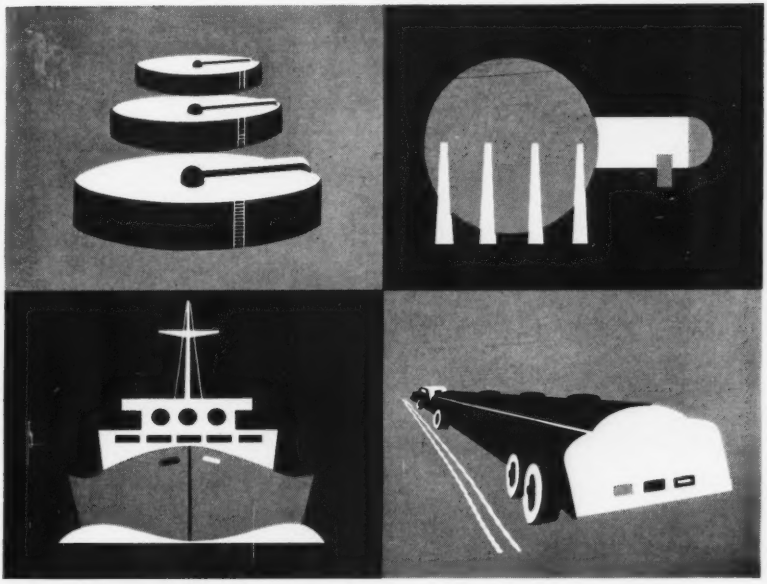

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this was so unnecessary

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Most uncontrolled fires are unnecessary. The damage in property destroyed, plants lost, inventories wiped out, records ruined, and businesses shut down can never be recovered. A Blaw-Knox *Automatic* Sprinkler System can stop fires at their origin, minimize damage to a small area, and pay for itself in a few years by savings in reduced insurance premiums.

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BLAW-KNOX COMPANY

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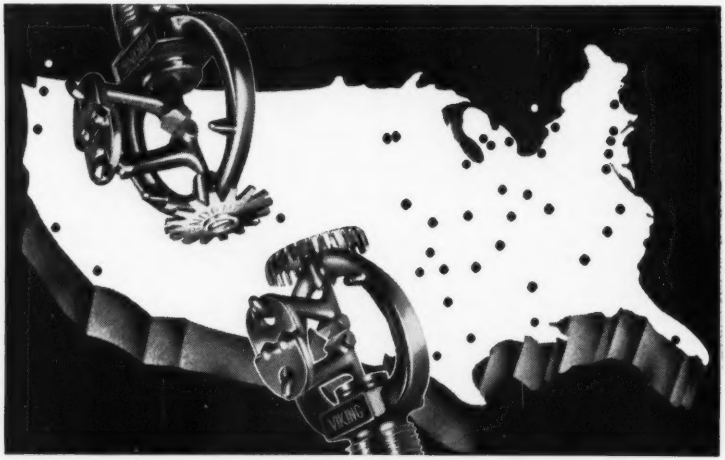

VIKING SPRINKLER FIRE PROTECTION

for any condition whatever it happens to be!

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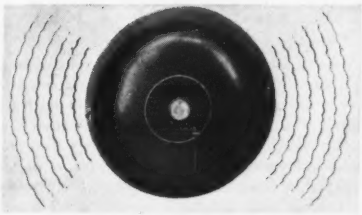
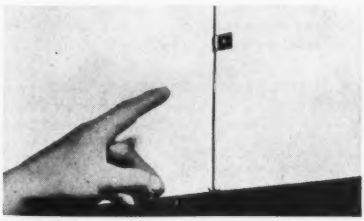
HASTINGS, MICHIGAN

FIRE ALARM!

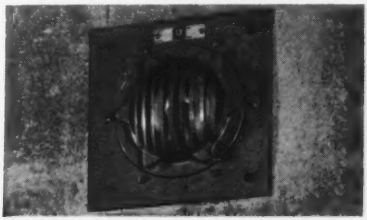


1. Save priceless lives, protect valuable buildings with the Kidde Atmo Fire Detecting and Alarm System!

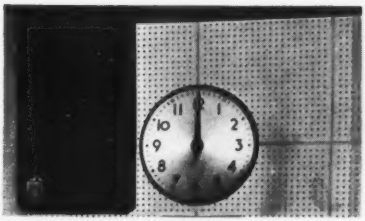
2. This automatic detecting and warning system sounds an alarm instantly at the *first* hot breath of fire!



3. Using rate-of-temperature-rise tubing as a sensing element, the system works without outside power!



4. Kidde's Atmo system can sound alarm at fire area, outside the building or at local fire department station!



5. Kidde's Atmo system also gives fire location at a panel near any manned telephone switchboard!

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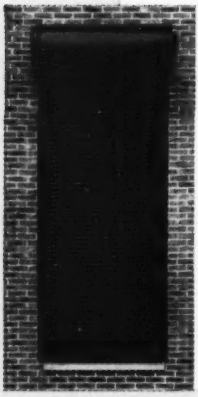
FIRE DETECTION
J. H. SCHARFF, INC.
151 Main Street, Orange, N. J.

A Subsidiary of
Walter Kidde & Company, Inc.

For fast, dependable fire detection and warning, install a Kidde Atmo Fire Alarm System. Ideal where life protection and early fire warning is essential, the Kidde Atmo system can also close doors, shut off fans, motors, blowers, is automatically re-setting after use or test. Get more information! Write today and ask for Kidde's Atmo Alarm Systems booklet!

Automatic Rolling Steel
FIRE DOORS *and* WINDOW SHUTTERS
PREVENT SPREAD *of* FIRE!



You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog G-57.

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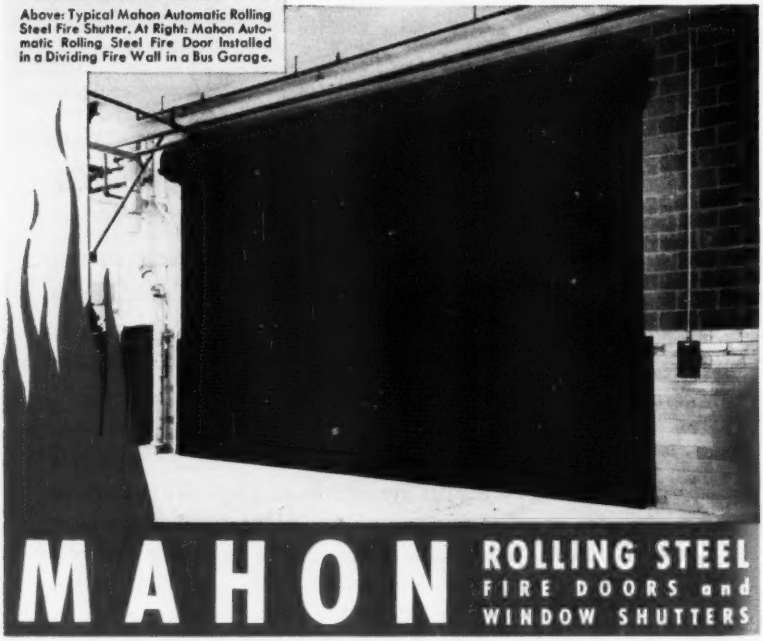
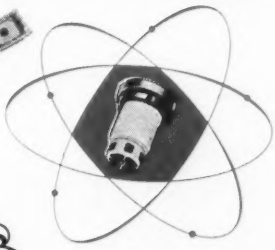
Branch Offices in New York and Chicago • Representatives in Principal Cities
Manufacturers of Standard and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Window Shutters; Underwriters' Rated Metaklad Fire Walls; Insulated Metal Curtain Walls; Electrified M-Floors; Steel Roof Deck; Acoustical Long Span M-Decks; and Acoustical and Troffer Forms.

Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS

Nuclear energy takes over the fire watch...



The MILLION DOLLAR MINUTE...

No minutes are more valuable than those lost between the invisible beginnings of a fire and its detection. Now nuclear energy, adapted to an electronic device, saves those precious minutes while fire is in its incipient stage. Because PYR-A-LARM's nuclear heart is sensitive to the invisible products of combustion that precede heat and flame, it sounds the alarm long before conventional thermal devices can function.

If you would like a demonstration of the PYR-A-LARM system in your own offices or additional information, write today. *Approved by Underwriter's Laboratories Inc. and Factory Mutual Laboratories.*

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Douglas Aircraft Co.
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A DIVISION OF BAKER INDUSTRIES, INC.

NUCLEAR FIRE DETECTION AND ALARM SYSTEMS

P. O. Box 390, Newark 1, New Jersey

HOPE THEY DON'T RING THE BELL

Let the fire fighters rest. Protect your building investment from fire. Specify Lexsuco Fire Retardant Roof Constructions to reduce fire hazard. They eliminate combustible asphaltic materials from between the roof deck and insulation. Lexsuco Roofing has been tested and classified Class I by Factory Mutual.

LEXSUCO INC. *Write for informative brochure*

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Shielding your plant from fire

. . . through quality control

of AER-O-FOAM liquids

From the time raw materials are received until finished products are shipped, National AER-O-FOAM liquids undergo 70 separate inspections.

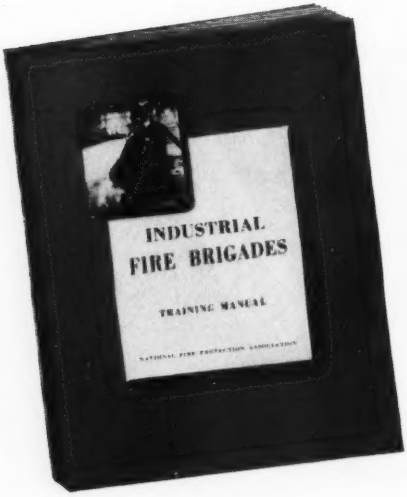
This, we believe, is the most rigid system of quality control in the industry. Every safety engineer can have full confidence that foams made with National liquids will have full extinguishing power.

NATIONAL FOAM System, Inc.

West Chester, Pa.

NFPA

INDUSTRIAL FIRE BRIGADES Training Manual



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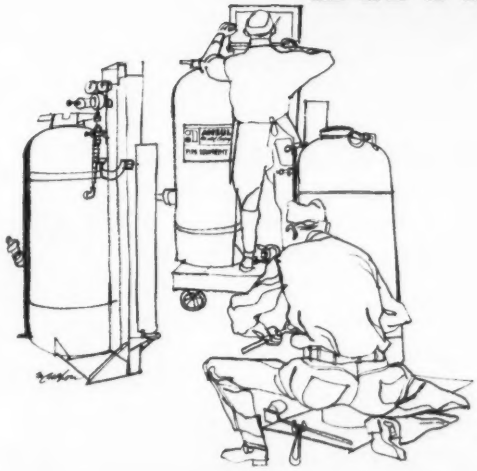
IN MAKING FIRE EXTINGUISHING EQUIPMENT...OR REFRIGERATION PRODUCTS...OR CHEMICALS...OR WIDGETS

PEOPLE ARE THE REAL COMPETITIVE DIFFERENCE



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REEVE
HEAVY DUTY ALARM BELLS
GONGS and BUZZERS
Weatherproof
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Weatherproof —
Sizes 3", 4", 6", 8", 10", 12"
DC—6—220 V. · AC—12—220 V.

Watertight —
Sizes 3", 4", 6", 8", 10", 12"
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OPEN PIGTAIL • WEATHERPROOF • E-Z MOUNT
Sizes 6", 8", 10". Cast aluminum housing
Hot Pressed Steel Gong Shell
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Voltages are the same as Neck Type

Special Windings on request.

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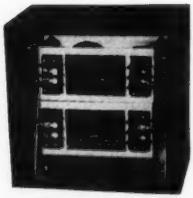
Write for Catalog Material and Prices!

AUTOMATIC BATTERY CHARGER, High and Low Current

The unit is designed for use on any storage batteries not subject to heavy drains. It will trickle charge the battery indefinitely because of its automatically decreasing rate of charge.

For use with six cells (12 volts). Automatically controlled by saturable reactor. Continuous output one ampere. 22.5 watts, 118 volts, 60 cycles. 3% Regulation. 9" x 9" x 6" — 14 B & S gauge steel wall cabinet. 15¼ lbs. U.L. Approved. No moving parts.



MODEL BC-12

Manufacturers of a complete line of
CENTRAL OFFICE and LOCAL FIRE ALARM DEVICES
• automatic alarm devices • sprinkler alarm and supervisory devices • burglar alarm devices and accessories. DYNALARM (sound detection for both reverberant and non-reverberant vaults).

THE REEVE ELECTRICAL CO., Inc.
120 West 42nd Street, New York 36, N.Y.

He's leaving an important message for you!

When a gas-vent installer places the red-and-black Metalbestos "Safety System" Seal above a gas appliance's draft hood, he's giving the finishing touch to a safe, trouble-free gas vent. It's his assurance to inspectors that an all-Metalbestos gas vent has been designed and installed according to the Metalbestos "Safety System" Gas Vent Tables.

Watch for the Metalbestos "Safety System" Seal. It's the quality symbol of a modern gas vent . . . scientifically guaranteed for safe performance and life-time service.

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WILLIAM WALLACE COMPANY · BELMONT CALIF.

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For your complimentary copy of the new "Safety System" Installation Guide, contact your nearest Metalbestos representative or write Dept. T-1

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GIVES YOU MORE — FOUR WAYS

UPRIGHT SPRAY SPRINKLER

PENDENT SPRAY SPRINKLER

APPROVED BY
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SIDEWALL SPRINKLER

LISTED BY
UNDERWRITERS' LABORATORIES, Inc.

SMALL ORIFICE SPRINKLER
(With Identifying Pintle)

1 **SUPERIOR PROTECTION** . . . due to more efficient water distribution. Proven by tests under actual fire conditions for all classes of hazards.

2 **MORE EFFECTIVE USE OF LESS WATER** . . . because wider distribution and break-up of the water discharged provides greater cooling and extinguishment.

3 **CEILING PROTECTION BY COOLING — NOT WETTING** . . . All the water goes onto the fire. The break-up of water results in complete cooling and control of flammable vapors.

4 **MORE FIRE CONTROL WITH FEWER SPRINKLERS** . . . because ceiling temperatures are kept lower, fewer sprinklers open. Immediate water saturation of the fire area prevents the spread of fire. Hot gases become impotent in the cooled atmosphere.

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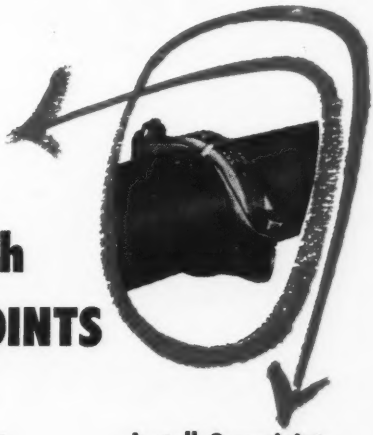
Westmoreland & Collins Sts., Phila. 34, Pa.

Licensees in principal cities of the United States and Canada

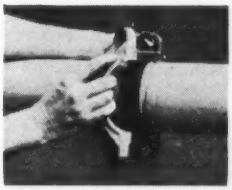
Couple Pipe the Easy, Low Cost Way with New G-B GRUVAJOINTS



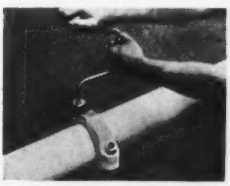
Now you can save up to 25% when connecting pipe for bulk runs and risers. Yes, contractors are saving money every day when they use new lightweight Gruvajoints. There's no flanging, no threading, no welding, and there's no need for heavy chain tongs or pipe wrenches. Gruvajoints are truly the modern way to couple pipe. Write today for free illustrated brochure on G-B Pipe Coupling Products. Gruvajoints are now available in 2", 2½", 3", 4", 5", 6" and 8" sizes.

Install Gruvajoints in three easy steps

Grease gasket and center over pipe ends.



Lay housing halves into grooves and insert bolts.



Tighten the two nuts equally.

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Underwriters' Laboratories, Inc.
File EX 1741A and B

APPROVED by
Factory Mutual Engineering Division
Report Serial No. 13097

GUSTIN-BACON
manufacturing company
210 W. 10th St. Kansas City, Missouri

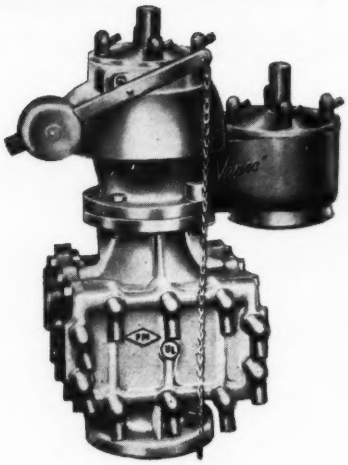
EXTRA SAFETY

at LOW COST...

"Varec"

FLAME ARRESTERS

in combination with your VENT VALVES



Flame Arrester Unit listed by UNDERWRITERS' LABORATORIES Approved by Associated Factory Mutuals Laboratories and other governing agencies.

"Varec" Fig. No. 5800 Vent Unit consisting of "Varec" Conservation Vent Valve in combination with "Varec" Flame Arrester.

The larger area of the multi-plate Flame Arrester bank, greater flow per minute through the Flame Arrester passageways are the "plus" factors to give you extra safety when you install "Varec" Conservation Vent Units. Protection against entry of flame through the venting device is certain when "Varec" Flame Arresters are used. Excessive pressure or vacuum is avoided by use of the "Varec" Vent Valve. The combination unit gives you complete security against the major hazards of flammable liquid storage yet average installation approximately 1/10 of 1% of your investment in tank and product. Consult your nearest "Varec" representatives or write factory.

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THE VAPOR RECOVERY SYSTEMS COMPANY

2820 NORTH ALAMEDA STREET

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CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

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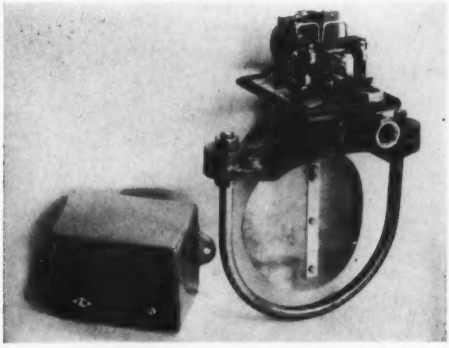


Model PRS-1

Sprinkler

Waterflow Alarm

This device is approved by Factory Mutual Laboratories and Underwriters' Laboratories, Inc.

- This device is also made as Model PRT-1, a coded waterflow transmitter.

5-inch size shown above. To install simply drill 2-inch hole in pipe.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, which prevents false alarms.
- Has enclosed electrical contacts for any voltage not exceeding 15 amp. 125 volts, A.C. and ½ amp. 125 volts, D.C. Operates on all water pressures or surges.

Tempo-Set Model A Fire Detector

Underwriters' Laboratories, Inc. Approved.

- Self restoring and can be heat tested.
- Electrical contacts are silver or gold and are enclosed.
- Very reasonable price.

Size is 1⅝" x ⅝"

- Tempo-set Model A is approved in either open or closed circuit and the temperature ratings are 135 and 200 degrees.
- Approved spacing is 20' x 20'.
- Electric ratings are 125 volts 1 ampere, A.C. or 24 volts 0.5 ampere D.C. or less.

IN ALL ITS **RELIABILITY!**

Every minute of the day and night, Reliable automatic sprinklers are acting as miniature fire control teams . . . standing ready to automatically detect, sound the alarm, and extinguish fires in their incipient stages.

This is the kind of Fire Control that is absolutely RELIABLE! For over thirty-five years, Reliable Automatic Sprinklers have been guarding life and property from threat of fire . . . without one report of failure.

The complete Reliable Line offers a wide selection of automatic sprinkler devices for every condition . . . including Spray, Sidewall, Conventional and Open Sprinklers; Alarm Valves; Dry Pipe Valves; Accelerators; Mechanical and Electric Alarms; and a full line of sprinkler accessories.

For perfect FIRE CONTROL . . . Let your local Reliable Licensee show you the RELIABLE FIRE CONTROL TEAM . . . We'll see that he contacts you promptly.

Licensees in principal cities of the U.S., Canada, and foreign countries.

Manufactured and Distributed by

THE RELIABLE AUTOMATIC SPRINKLER CO. INC.

NOW... Kuhns ductile iron fittings

For Sprinkler Systems

Kuhns ductile iron pipe fittings—the newest development in piping—provide an extra margin of operating safety for sprinklers, high pressure lines and other vital piping systems. High structural strength and resistance to thermal shock help these fittings prevent leakage caused by vibration, temperature changes or misalignment.

"K" Pipe Lock Couplings

Listed for 800 psi by Underwriters' Laboratories, Inc., these couplings have a safety factor of five times the UL listing for 2½" through 6" and four times UL listing for 8". Sizes: 2½" through 8". Look for the "800 D" on each.

"K" Flanges and Flanged Fittings

Pressure rating, 500 psi by Underwriters' Laboratories, Inc. for elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Flat faced flanges standard. Extra heavy flange dimensions and raised faces available. Look for the "DI 500" on each.

Complete range of sizes through 12".

"K" Screwed Fittings *

Pressure ratings listed by Underwriters' Laboratories, Inc.

STEAM AND OIL AT 550°F
¼" to 3".....300 lbs.
LIQUID AND GAS AT 150°F
¼" to 1".....2000 lbs.
1¼" to 2".....1500 lbs.
2½" to 3".....1000 lbs.

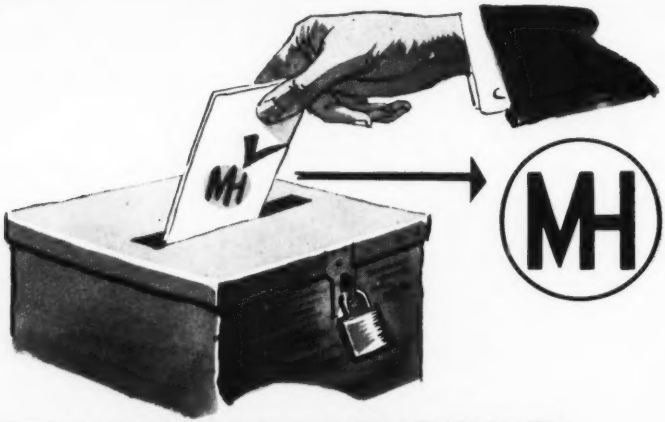
**Ductile iron fittings are available in any size in Kuhns complete cast iron line, ¼" through 12".*

Note: These fittings are excellent for liquefied petroleum gas systems. Look for the "DI 300" on each.

Send for our catalog or contact your wholesaler.

THE KUHNS BROTHERS CO.
1800 McCALL STREET, DAYTON, OHIO

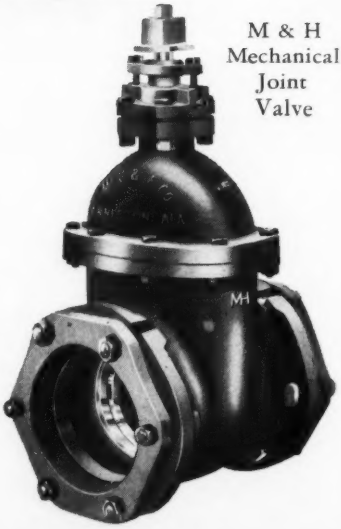
1887 • 70 Years of Continuous Progress • 1957



ENGINEERING BALLOT BOX

We like to think of M & H valves and hydrants as "candidates" in an election contest. The "voters" are the engineers and water works men of the United States. The "ballots" are material specifications and purchase orders. As this "election" stands today, M & H products rank high among the winners.

For many years, the sale and use of M & H valves and hydrants has been rapidly and steadily growing. Our company has become a leading producer of valves, hydrants and accessories. Returns from the engineering ballot box we consider as an emphatic vote of confidence. Our pledge, therefore, is that M&H products shall continue to merit that confidence through the years to come.



M & H Mechanical Joint Valve

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF WALWORTH

Technical Men seeking a challenge . . . ever think of MARKETING as an opportunity?

Step into new Fields with NOTIFIER

leading manufacturer of U.L. & F.M. listed automatic fire detection systems, sprinkler supervisory equipment, and municipal fire alarms.

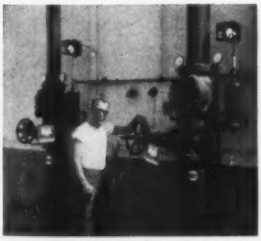
Demonstrating newest proprietary system to interested fire officials

A limited number of district **sales areas** are available to *outstanding men of vision, organizing* ability and technical competence who can build an alert, aggressive dealer organization. As a progressive manufacturer of quality alarm signaling equipment, NOTIFIER is anxious to complete its nationwide sales distribution.

Preparing to visit plant engineers

Or . . . attractive **dealer franchises** can be secured by men of character and integrity possessing a good sales and service record, or equal achievements, who would be happy operating a successful, independent fire alarm business.

The men selected are provided training in — local and national fire regulations, application of sound fire prevention and protection principles, marketing analysis, installation and servicing of **NOTIFIER** fire alarm equipment in industrial, institutional or municipal applications.



Inspecting and servicing a NOTIFIER system

Write for full details and send resume of experience to:

NOTIFIER Automatic FIRE ALARM

Field Sales Manager
NOTIFIER CORPORATION
Dept. K
239 South 11th Street
Lincoln 8, Nebraska

New Design Sprays Water More Evenly Over Wider Area!

It's hard to improve on the best, but we've done it! By re-designing our already superior "Automatic" Spray Sprinkler, we have come up with a model that has an even *better* distribution pattern. We also made the casting more rugged. The resultant increase in efficiency means better performance in case of fire. While we were at it, we improved our sprinkler's appearance.

Available for upright or pendant installation.

Ask your nearest "Automatic" Sprinkler fire safety engineer or write to us for complete information.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

Now! Telegraph and Voice in One Alarm Box

Gives Fastest Action for Fires and Emergencies

Now, you can have real two-in-one protection for your community . . . fast, automatic signalling for fire alarms and multi-purpose voice for general emergencies. The Gamewell "Citizen's Emergency Center," just developed as a combination system, provides the ideal type of communication for reporting the two basically different types of emergencies found in every community. The inherent speed, safety and positive identification features of telegraph fire reporting are retained — plus an independent voice circuit for reporting non-fire emergencies over a special private-line circuit to police or central switchboard. A Police Privacy Alarm System is also available.

Write for complete details! Give your community maximum protection at minimum cost. Here is the opportunity for a completely integrated and independent Fire and Emergency Alarm System always ready for use on a 24-hour basis. Ask for further details from:

GAMEWELL®

THE GAMEWELL COMPANY
Newton Upper Falls 64, Mass.
In Canada: Northern Electric Co., Ltd., Belleville, Ont.
First When Seconds Count

The Story behind Grinnell Fire Protection

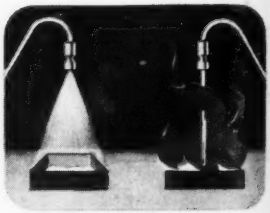
IN THE LABORATORY Water, when correctly applied, is effective in extinguishing flammable liquids. Though the same amount of water is being employed in both discharges during laboratory experiment illustrated at right, only the finely dispersed spray has resulted in extinguishment.

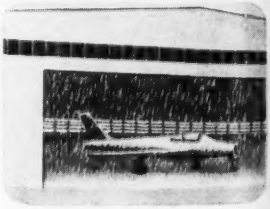
ON THE PROVING GROUND In a test which closely simulates an actual transformer fire, the blaze was allowed to gain full headway — then put out in seconds by a battery of Mulsifyre projectors and ProtectoSpray nozzles . . a further demonstration of the effectiveness of water spray when properly applied.

DESIGN AND INSTALLATION Robins Air Force Base in Georgia has a Grinnell Mechanical Foam System. In a sequence filmed during official Air Force acceptance tests, you'll witness this system in operation. Additional installations of Grinnell systems at power stations, substations, chemical plants and other industrial locations are shown in the film.

FIRE PROTECTION THROUGH RESEARCH

A 35-minute 16mm sound film in full color demonstrating water spray, foam, carbon dioxide and dry chemical fire protection for special hazards.





GRINNELL
WHENEVER FIRE PROTECTION IS INVOLVED

Arrange a group showing of this film. There is no cost or obligation. To obtain a print, write: Grinnell Company, Inc., 277 West Exchange St., Providence, Rhode Island.

Manufacturing, Engineering, and Installation of Fire Protection Systems since 1870